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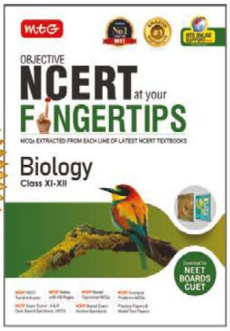

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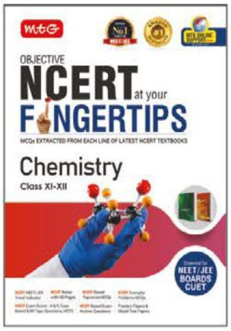

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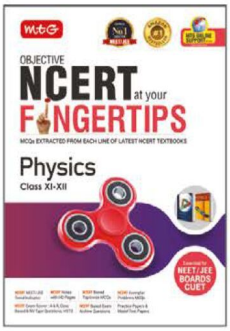

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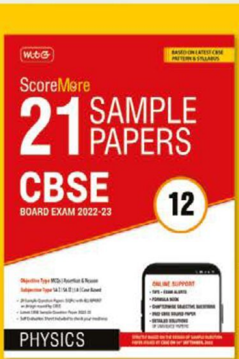
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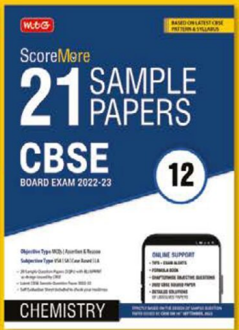
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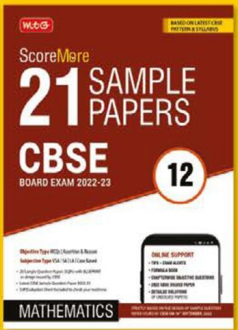
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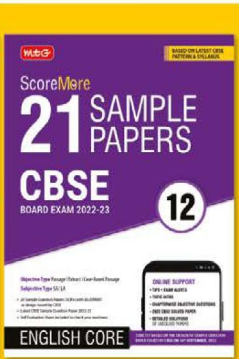
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PRACTICE PAPER

NEET 2023

Exam on
7th May 2023

SECTION - A (BOTANY)

1. Which of the following statements correctly defines key?
   (a) It is a taxonomical aid used for the identification of plants and animals based on the similarities and dissimilarities.
   (b) It is a taxonomical aid used for the identification of plants and animals based on the dissimilarities only.
   (c) It is a taxonomical aid used for the identification of plants and animals based on the similarities only.
   (d) None of these

2. Which award has given by government of India for individuals or communities from rural areas that showed extraordinary courage and dedication in protecting wildlife?
   (a) Amrita Devi Bishnoi Wildlife Protection Award
   (b) Rajiv Gandhi National Wildlife Conservation Award
   (c) The Jeanne Marching Animal Welfare Award
   (d) The Wildlife Sanctuary Award

3. Match the column I with column II and select the correct option.

Column I		Column II	
A.	Virus	(i)	Citrus canker
B.	Bacteria	(ii)	Mumps
C.	Prion	(iii)	Potato spindle tuber disease
D.	Viroid	(iv)	Mad cow disease

	(A)	**(B)**	**(C)**	**(D)**
(a)	(ii)	(i)	(iv)	(iii)
(b)	(iii)	(i)	(ii)	(iv)
(c)	(iii)	(ii)	(i)	(iv)
(d)	(iii)	(i)	(iv)	(ii)

4. Read the given statements and select the correct option.
   Statement 1 : Occurrence of more than one embryo in a seed is referred as polyembryony.
   Statement 2 : Apomixis is an asexual reproduction that produces seeds without fertilisation.
   (a) Both statements 1 and 2 are correct.
   (b) Both statements 1 and 2 are incorrect.
   (c) Statement 1 is correct but statement 2 is incorrect.
   (d) Statement 1 is incorrect but statement 2 is correct.

5. Which of the following statements is incorrect regarding mosses?
   (a) The predominant stage of life cycle is gametophytic phase.
   (b) The protonema stage develops directly from a spore.
   (c) The leafy stage develops from the secondary protonema as lateral bud.
   (d) Protonema stage bears the sex organs.

6. Which of the following is not a characteristic feature of desert plant?
   (a) Sunken stomata
   (b) Cuticle on leaf surface
   (c) Leaves reduced to spines
   (d) None of these

7. Read the given statements and select the correct option.
   Statement 1 : When the carpels are free, gynoecium is called apocarpous.
   Statement 2 : When the carpels are fused, gynoecium is called syncarpous.
   (a) Both statements 1 and 2 are correct.
   (b) Statement 1 is correct but statement 2 is incorrect.
   (c) Statement 1 is incorrect but statement 2 is correct.
   (d) Both statements 1 and 2 are incorrect.

8. Which of the following statements is incorrect?
   (a) Characters are controlled by factors.
   (b) ABO blood grouping is an example of multiple allelism.
   (c) Factors occur in pairs.
   (d) A genotypic ratio of monohybrid cross is 3:1.

9. Bast fibres are made up of
   (a) parenchyma (b) collenchyma
   (c) sclerenchyma (d) subsidiary cells.

10. Each trophic level having a certain mass of living material at a particular time is called as

(a) productivity (b) biomagnification
(c) standing crop (d) standing state.

11. Match the column I with column II and select the correct option.

Column I		Column II	
(i)	RER	A.	Synthesis of lipid
(ii)	SER	B.	Synthesis of protein
(iii)	Golgi apparatus	C.	Packaging of material
(iv)	Lysosome	D.	Digest carbohydrates and nucleic acids.

(a) (i)-B; (ii)-A; (iii)-C; (iv)-D
(b) (i)-A; (ii)-B; (iii)-C; (iv)-D
(c) (i)-A; (ii)-B; (iii)-D; (iv)-C
(d) (i)-C; (ii)-D; (iii)-A; (iv)-B

12. How many different genetic varieties of *Oryza sativa* are present in India?

(a) Less than 50,000 (b) More than 50,000
(c) 1000 (d) 20,000

13. Who observed that plants composed of different kinds of cells that are responsible for formation of plant tissues?

(a) Theodore Schwann (b) Matthias Schleiden
(c) Camillo Golgi (d) George Palade

14. Polymorphism is

(a) similarities at the genetic level
(b) variations at genetic level arise due to mutations
(c) a small stretch of repeating DNA
(d) variations at the phenotypic level.

15. Which of the following is the final event of meiotic prophase I?

(a) Pairing of homologous chromosomes
(b) Dissolution of synaptonemal complex
(c) Recombination between homologous chromosomes
(d) Terminalisation of chiasmata

16. Verhulst-Pearl Logistic growth is described by which equation?

(a) $dN/dt = rN [K-N/K]$ (b) $dN/dt = rn$
(c) $dt/dN = rn$ (d) $dt/dN = rN [K-N/K]$

17. Select the correct statement.

(a) When cell is placed in hypotonic solution, water diffuses into cell causing the cytoplasm to build a pressure against the wall.
(b) When cell is placed in isotonic solution, water diffuses into cell causing the cytoplasm to build a pressure against the wall.
(c) When cell is placed in hypertonic solution, water diffuses into cell causing the cytoplasm to build a pressure against the wall.
(d) When cell is placed in hypotonic solution, water moves out of the cell causing the cytoplasm to build a pressure against the wall.

18. On the basis of following characteristics, identify the plant.

I. Both male and female flowers are present on the same plant.
II. It prevents autogamy but not geitonogamy.

(a) Papaya (b) Castor
(c) Maize (d) Both (b) and (c)

19. Read the given statements and select the correct option.

Statement 1 : Sulphur is present in amino acids cysteine and methionine.

Statement 2 : Potassium is a constituent of cell membranes, certain proteins, nucleic acids and nucleotides.

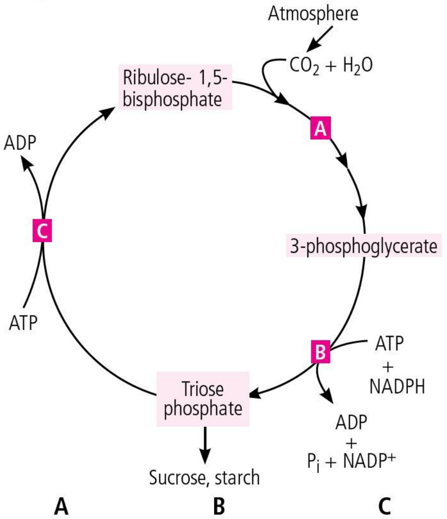
(a) Both statements 1 and 2 are correct.
(b) Statement 1 is correct but statement 2 is incorrect.
(c) Statement 1 is incorrect but statement 2 is correct.
(d) Both statements 1 and 2 are incorrect.

20. Match the column I with column II and select the correct option.

Column I		Column II	
A.	Incomplete dominance	(i)	3:1
B.	Monohybrid cross	(ii)	1:2:1
C.	Dihybrid cross	(iii)	9:3:3:1

	A	B	C
(a)	(ii)	(i)	(iii)
(b)	(iii)	(ii)	(i)
(c)	(i)	(ii)	(iii)
(d)	(ii)	(iii)	(i)

21. Refer to the given figure and identify the correct option regarding A, B and C.



	A	B	C
(a)	Reduction	Regeneration	Carboxylation
(b)	Regeneration	Carboxylation	Reduction
(c)	Carboxylation	Reduction	Regeneration
(d)	Reduction	Carboxylation	Regeneration

22. Consider the following statements regarding the packaging of DNA Helix.

(i) The organisation is much more complex in eukaryotes.
(ii) They have positively charged and basic proteins called histones.
(iii) Histones are organised to form a unit of eight molecules called histone octamer.
(iv) Positively charged DNA is wrapped around the negatively charged histone octamer to form a structure called nucleosome.
(v) Nucleosomes constitute the repeating unit of a structure in nucleus called chromatin.

Of the above statements

(a) (i), (ii), (iii) and (iv) are correct.
(b) (i), (ii), (iv) and (v) are correct.
(c) (i), (iii), (iv) and (v) are correct.
(d) (i), (ii), (iii) and (v) are correct.

23. What is the value of RQ for fats?

(a) 1
(b) More than 2
(c) More than 1
(d) Less than 1

24. Match column I with column II and select the correct answer from codes given below.

	Column I		Column II
A.	Water (Prevention and Control of Pollution) Act	(i)	2002
B.	Environment (Protection) Act	(ii)	1974
C.	Earth Summit	(iii)	1992
D.	World Summit on Sustainable Development	(iv)	1986

	(A)	**(B)**	**(C)**	**(D)**
(a)	(ii)	(iv)	(iii)	(i)
(b)	(iv)	(ii)	(iii)	(i)
(c)	(ii)	(iv)	(i)	(iii)
(d)	(iv)	(ii)	(i)	(iii)

25. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : Abscisic acid inhibits seed germination .

Reason (R) : Abscisic acid stimulates the closure of stomata.

In the light of the above statements, choose the correct answer from the options given below.

(a) Both (A) and (R) are correct and (R) is the correct explanation of (A).
(b) Both (A) and (R) are correct but (R) is not the correct explanation of (A).
(c) (A) is correct but (R) is not correct.
(d) (A) is not correct but (R) is correct.

26. The vegetative propagule in *Agave* is

(a) leaf buds
(b) rhizome
(c) bulbil
(d) offset.

27. Which of the following is an example of Class Lycopsida?

(a) *Cycas*
(b) *Pinus*
(c) *Ginkgo*
(d) *Selaginella*

28. Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : Primary endosperm nucleus (PEN) is triploid.

Reason (R) : PEN is formed from fusion of two male gametes with egg cell.

Read the above statements, choose the correct answer from the options given below.

(a) Both (A) and (R) are correct and (R) is the correct explanation of (A).
(b) Both (A) and (R) are correct but (R) is not the correct explanation of (A).
(c) (A) is correct but (R) is not correct.
(d) (A) is not correct but (R) is correct.

29. Pleiotropic gene is/are

(a) single gene exhibits multiple phenotypic expression
(b) multiple genes exhibits multiple phenotypic expression
(c) single gene exhibits single phenotypic expression
(d) multiple genes exhibit single phenotypic expression.

30. Read the given statements.

(i) In racemose inflorescence, the main axis continues to grow.
(ii) In racemose inflorescence, the flowers are borne laterally in an acropetal order.
(iii) In cymose inflorescence, the flowers are borne in a basipetal order.
(iv) In cymose inflorescence, the main axis terminates in flower.

Of the above statements, the correct ones are

(a) (i) and (iii) only
(b) (i), (ii), (iii) and (iv)
(c) (i), (ii) and (iii)
(d) (i) and (ii) only

31. Match the column I with column II and select the correct answer from the given codes.

	Column I		Column II
A.	Golden rice	(i)	Controls corn borer
B.	*cry*IAb	(ii)	Isolated from *Bacillus thuringiensis*
C.	*Bt* toxin	(iii)	Vitamin A enriched
D.	RNAi	(iv)	Kills *Meloidogyne incognita*

	(A)	**(B)**	**(C)**	**(D)**
(a)	(iii)	(i)	(ii)	(iv)
(b)	(i)	(iii)	(ii)	(iv)
(c)	(iii)	(i)	(iv)	(ii)
(d)	(i)	(iii)	(iv)	(ii)

32. Down's syndrome is caused due to
(a) presence of an additional copy of X-chromosome
(b) presence of an additional copy of the chromosome number 21
(c) absence of one of the X chromosomes
(d) presence of an additional copy of the chromosome number 18.

33. The first product in the C_4 pathway is
(a) oxaloacetate
(b) 3-Phosphoglyceraldehyde
(c) triose phosphate
(d) ribulose-1,5-bisphosphate.

34. Read the given statements and select the correct option.
Statement 1: DNA is a genetic material is proved by the experiments done by Alfred Hershey and Martha Chase.
Statement 2: Hershey and Chase worked on *Streptococcus pneumoniae* bacteria.
(a) Both statements 1 and 2 are correct.
(b) Both statements 1 and 2 are incorrect.
(c) Statement 1 is correct but statement 2 is incorrect.
(d) Statement 1 is incorrect but statement 2 is correct.

35. The process of copying genetic information from one strand of DNA into RNA is termed as
(a) transcription (b) translation
(c) mutation (d) translocation.

SECTION - B

Attempt any 10 questions out of 15.

36. When a molecule moves across a membrane independent of other molecules, the process is called_________.
(a) symport (b) uniport
(c) antiport (d) osmosis.

37. In aminoacylation of *t*RNA,
(a) amino acids are activated in the presence of ATP and linked to their cognate *t*RNA
(b) amino acids are activated in the absence of ATP and linked to their cognate *t*RNA
(c) amino acids are activated in the presence of $NADP^+$ and linked to their cognate *t*RNA
(d) amino acids are activated in the presence of $NADP^+$ and linked to their complementary *m*RNA.

38. Which one of the following statements is correct?
(a) Mitosis involves two sequential cycles of nuclear and cell division but only a single cycle of DNA replication.
(b) In metaphase of mitosis, chromatids move to opposite poles.
(c) In anaphase of mitosis, spindle fibres attached to kinetochores of chromosomes.
(d) In mitosis, the number of chromosomes in the parent and progeny cells are the same.

39. Which one of the following statements is incorrect?
(a) In commensalism, when two species interact with each other, one species is benefited and the other, is neither benefitted nor harmed.
(b) In amensalism, when two species interact with each other, one species is harmed whereas the other is unaffected.
(c) In mutualism, when two species interact with each other, both species are non-beneficial to each other.
(d) In competition, when two species interact with each other, both species are harmed.

40. Immigration is
(a) the number of individuals of the population who left habitat and gone elsewhere during the time period under consideration
(b) the number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration
(c) the number of births during a given period in the population that are added to the initial density
(d) the number of deaths in the population during a given period.

41. Which of the following elements delay flowering if their concentration is low in plants?
(a) N (b) S
(c) Mo (d) All of these

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For MTG Learning Media Pvt. Ltd.
Mahabir Singh
Director

42. Productivity is expressed in the form of
(a) kgm^{-1} yr^{-2} (b) gm^{-2} yr^{-1}
(c) m^{-2} yr^{-1} (d) gm^{-1} yr^{-2}.

43. According to an estimate, ________ of carbon is fixed annually in the biosphere through photosynthesis.
(a) 8×10^{13} kg (b) 4×10^{13} kg
(c) 2×10^{6} kg (d) 6×10^{13} kg

44. Vernalisation is the process in which flowering is either quantitatively or qualitatively dependent on exposure to
(a) low temperature (b) high temperature
(c) constant temperature (d) none of these.

45. Term biodiversity was popularised by
(a) Edward Wilson (b) Robert May
(c) Ramdeo Misra (d) Ernst Haeckel.

46. Read the given statements and select the correct option.
Statement 1 : Heartwood is the peripheral region of secondary xylem.
Statement 2 : Sapwood is the region comprising of dead elements with highly lignified walls.
(a) Both statements 1 and 2 are correct.
(b) Statement 1 is correct but statement 2 is incorrect.
(c) Statement 1 is incorrect but statement 2 is correct.
(d) Both statements 1 and 2 are incorrect.

47. The DNA fragments in agarose gel electrophoresis are separated on the basis of
(a) concentration of DNA (b) size
(c) charge (d) both (b) and (c).

48. Ozone is measured in
(a) Dobson unit (b) decibel
(c) ppm (d) joule.

49. Life cycle of the plants shows alternation of generations between
(a) haploid sporophyte and diploid gametophyte
(b) diploid sporophyte and haploid gametophyte
(c) diploid sporophyte and diploid gametophyte
(d) haploid gametophyte and haploid sporophyte.

50. Which one of the following is a lectin?
(a) Abrin (b) Ricin
(c) Codeine (d) Concanavalin A

SECTION - A (ZOOLOGY)

51. Which one of the following classes of vertebrate bear fins?
(a) Cyclostomata (b) Reptilia
(c) Aves (d) Chondrichthyes

52. _______helps in maintaining the low temperature of the testes.
(a) Testicular lobules (b) Scrotum
(c) Sertoli cells (d) Leydig cells

53. In arthropoda, excretion takes place through
(a) flame cells (b) nephridia
(c) green glands (d) Malpighian tubules.

54. *In vivo* fertilisation is
(a) fusion of gametes within the female
(b) fertilisation outside the body in almost similar conditions as that in the body
(c) injection of a sperm directly into the ovum
(d) artificial introduction of semen either into the vagina or into the uterus.

55. Read the given statements and select the correct option.
Statement 1 : *Pila* and octopus are bilaterally symmetrical and diploblastic.
Statement 2 : Mollusca is the second largest animal phylum.
(a) Both statements 1 and 2 are correct.
(b) Statement 1 is correct but statement 2 is incorrect.
(c) Statement 1 is incorrect but statement 2 is correct.
(d) Both statements 1 and 2 are incorrect.

56. ________ perform cementing function to keep the neighbouring cells together.
(a) Gap junctions (b) Adhering junctions
(c) Tight junctions (d) Adipose tissue

57. The female reproductive system of cockroach consists of large ovaries, lying laterally in the
(a) 2nd - 6th abdominal segments
(b) 3rd - 5th abdominal segments
(c) 5th - 7th abdominal segments
(d) 4th - 5th abdominal segments.

58. Read the given statements and select the correct option.
Statement 1 : The ovaries are located one on each side of the upper abdomen.
Statement 2 : Fimbriae helps in collection of the ovum after ovulation.
(a) Both statements 1 and 2 are correct.
(b) Both statements 1 and 2 are incorrect.
(c) Statement 1 is correct but statement 2 is incorrect.
(d) Statement 1 is incorrect but statement 2 is correct.

59. A widely used diagnostic test for Acquired Immuno Deficiency Syndrome (AIDS) is
(a) ELISA (b) MRI
(c) CT scan (d) radiography.

60. Which of following is an example of hormonal birth control?
(a) Vasectomy (b) Foam
(c) CuT (d) Pill

61. The bile duct and the pancreatic duct open together into the duodenum as the common hepato-pancreatic duct which is guarded by

(a) sphincter of Oddi
(b) pyloric sphincter
(c) common bile duct
(d) gastro-oesophageal sphincter.

62. The correct arrangement of teeth in each half of the upper and lower jaw is
[Hint : Molar (M), Incisor (I), Canine (C), Premolar (PM)]
(a) M, PM, C, I (b) I, C, PM, M
(c) C, I, PM, M (d) I, C, M, PM.

63. Read the given statements and select the correct option.

Statement 1: In humans and *Drosophila*, females are homogametic and males are heterogametic.

Statement 2: In many birds, female has pair of similar chromosomes ZZ and male have two dissimilar ZW chromosomes.

(a) Both statements 1 and 2 are correct.
(b) Both statements 1 and 2 are incorrect.
(c) Statement 1 is correct but statement 2 is incorrect.
(d) Statement 1 is incorrect but statement 2 is correct.

64. Which one of the following statements is incorrect regarding bile?
(a) It helps in emulsification of fats.
(b) It breaks down the fat into very small micelles.
(c) Bile inactivates lipases.
(d) The bile released into the duodenum do not contain any enzymes.

65. Read the given statements and select the correct option.

Statement 1: Asthma leads to difficulty in breathing and causes wheezing.

Statement 2: Bronchi and bronchioles get inflammed in asthma.

(a) Both statements 1 and 2 are correct.
(b) Statement 1 is correct but statement 2 is incorrect.
(c) Statement 1 is incorrect but statement 2 is correct.
(d) Both statements 1 and 2 are incorrect.

66. Transformation is the procedure through which
(a) a piece of DNA is introduced in a host bacterium
(b) DNA fragments are separated according to their size
(c) a piece of protein is introduced in a host bacterium
(d) cells are separated according to their size.

67. Match the column I with column II and select the correct option.

	Column I		Column II
A.	O blood group	(i)	Clotting of blood
B.	AB blood group	(ii)	Universal donor
C.	RBCs	(iii)	Universal recipient
D.	Platelets	(iv)	Contain haemoglobin

	(A)	**(B)**	**(C)**	**(D)**
(a)	(ii)	(iii)	(iv)	(i)
(b)	(iii)	(ii)	(iv)	(i)
(c)	(ii)	(iii)	(i)	(iv)
(d)	(iii)	(ii)	(i)	(iv)

68. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

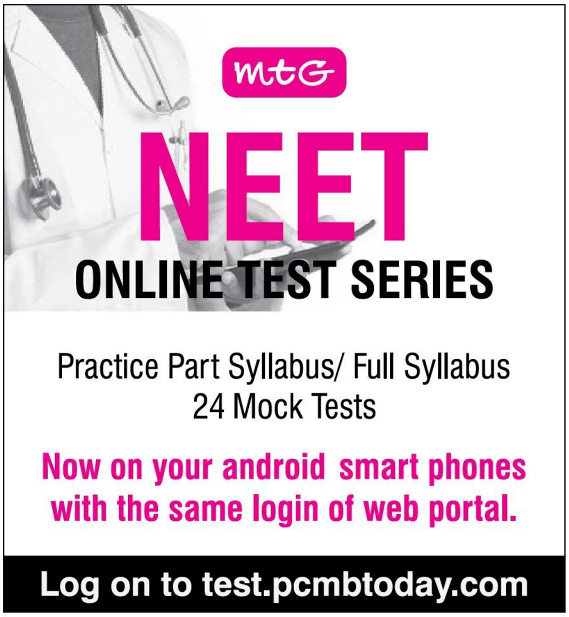
Assertion (A): Lactic acid bacteria grow in milk and convert milk into curd.

Reason (R): During growth, the LAB produces alkalies that coagulate and partially digest the milk protein.

In the light of the above statements, choose the correct answer from the options given below.
(a) Both (A) and (R) are correct and (R) is the correct explanation of (A).
(b) Both (A) and (R) are correct but (R) is not the correct explanation of (A).
(c) (A) is correct but (R) is not correct.
(d) (A) is not correct but (R) is correct.

69. In angina pectoris,
(a) a symptom of acute chest pain occurs when enough oxygen does not reach the heart muscle
(b) when heart does not pump blood effectively
(c) a symptom of high blood pressure which leads to heart diseases and affects vital organs like brain and kidney.
(d) it affects the vessels that supply blood to the heart muscles.

70. Read the given statements.
(i) In a polypeptide or a protein, amino acids are linked by a peptide bond.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(ii) In a polysaccharide, the individual monosaccharides are linked by glycosidic bond.
(iii) Collagen is the most abundant protein in the whole of the biosphere.
(iv) RuBisCO is the most abundant protein in animal world.

Of the above statements, the incorrect ones are

(a) (i), (ii) and (iii) only
(b) (i), (ii) and (iv) only
(c) (iii) and (iv) only
(d) (i) and (ii) only

71. The depolarisation of the ventricles is represented by

(a) P-wave
(b) QRS complex
(c) T-wave
(d) R-wave.

72. Which of the following statement(s) is/are true regarding Angiotensin II?

(a) It is a vasoconstrictor.
(b) It increases glomerular blood pressure.
(c) It is a vasodilator.
(d) Both (a) and (b)

73. Which one of the following was the biggest dinosaur among land reptiles?

(a) *Tyrannosaurus rex*
(b) *Crocodilian*
(c) *Stegosaurus*
(d) *Brachiosaurus*

74. Smooth muscles are

(a) non-striated in the appearance and involuntary
(b) striped in appearance under microscope
(c) under the voluntary control of the nervous system
(d) primarily involved in locomotory actions and changes of body postures.

75. Which one of the following is an incorrectly matched pair?

(a) Suspended solids – Sand, slit, clay
(b) Municipal solid wastes – Waste from homes, offices, stores, schools
(c) Colloidal material – Fecal matter, bacterium, cloth
(d) E-wastes – Paper, food wastes, plastics, glass

76. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : The afferent nerve fibres transmit impulses from tissues to CNS.

Reason (R) : The efferent fibres transmit regulatory impulses from the CNS to the concerned peripheral tissues .

In the light of the above statements, choose the correct answer from the options given below.

(a) Both (A) and (R) are correct and (R) is the correct explanation of (A).
(b) Both (A) and (R) are correct but (R) is not the correct explanation of (A).
(c) (A) is correct but (R) is not correct.
(d) (A) is not correct but (R) is correct.

77. Read the given statements and select the correct option.

Statement 1: Malignant tumor normally remain confined to their original location and do not spread to other body parts.

Statement 2: Benign tumor shows the property of metastasis.

(a) Both statements 1 and 2 are correct.
(b) Statement 1 is correct but statement 2 is incorrect.
(c) Statement 1 is incorrect but statement 2 is correct.
(d) Both statements 1 and 2 are incorrect.

78. The gaps between two adjacent myelin sheaths are called

(a) Schwann cells
(b) synaptic knob
(c) nodes of Ranvier
(d) Nissl's granules.

79. The α-cells of pancreas secrete _______ while the β-cells secrete _______.

(a) glucagon, insulin
(b) insulin, glucagon
(c) insulin, LH
(d) glucagon, ACTH

80. Match the column I with column II and select the correct option.

	Column I		Column II
A.	Echinodermata	(i)	*Sycon and Spongilla*
B.	Arthropoda	(ii)	*Nereis and Hirudinaria*
C.	Annelida	(iii)	*Ascaris and Ancylostoma*
D.	Aschelminthes	(iv)	*Culex and Aedes*
E.	Porifera	(v)	*Cucumaria and Ophiura*

	(A)	**(B)**	**(C)**	**(D)**	**(E)**
(a)	(iv)	(v)	(ii)	(iii)	(i)
(b)	(v)	(iv)	(ii)	(iii)	(i)
(c)	(iv)	(v)	(iii)	(i)	(ii)
(d)	(iv)	(v)	(i)	(iii)	(ii)

81. Absence of menstruation is an indication of

(i) ovum not fertilised
(ii) ovum fertilised
(iii) no pregnancy
(iv) pregnancy

Choose the correct option.

(a) (ii) and (iv)
(b) (ii) and (iii)
(c) (i) and (iv)
(d) (i) and (iii)

82. Read the given statements and select the correct option.

Statement 1: The body wall of the earthworm is externally covered by a thin non-cellular cuticle.

Statement 2: Earthworm exhibits the open circulatory system.

(a) Both statements 1 and 2 are correct.
(b) Statement 1 is correct but statement 2 is incorrect.
(c) Statement 1 is incorrect but statement 2 is correct.
(d) Both statements 1 and 2 are incorrect.

83. Which one of the following parts of sperm contain enzymes essential for fertilisation?

(a) Acrosome
(b) Middle piece
(c) Neck
(d) Tail

84. In which year, government of India legalised Medical Termination of Pregnancy (MTP) with some strict conditions to avoid its misuse?
(a) 1969 (b) 1975 (c) 1971 (d) 1989

85. Which one of the following statements is incorrect?
(a) The columnar epithelium is composed of a single layer of tall and slender cells.
(b) The cuboidal epithelium is composed of single layer of cube-like cells.
(c) The squamous epithelium is made of single thick layer of flattened cells with regular boundaries.
(d) The ciliated epithelium is composed of cuboidal cells bearing cilia on their free surface.

SECTION - B

Attempt any 10 questions out of 15.

86. Which of the following statements is not correct regarding the adaptive radiation?
(a) Different species in a given geographical area starting from a point and literally radiating to other areas of habitat.
(b) Darwin's finches represent one of the best examples of this phenomenon.
(c) Australian marsupials are another example of adaptive radiation.
(d) None of these

87. Read the given statements and select the correct option.
Statement 1: According to the Hardy-Weinberg principle, allele frequencies in a population are stable and constant from generation to generation.
Statement 2: Sum total of all the allelic frequencies is 1.
(a) Both statements 1 and 2 are correct.
(b) Both statements 1 and 2 are incorrect.
(c) Statement 1 is correct but statement 2 is incorrect.
(d) Statement 1 is incorrect but statement 2 is correct.

88. What is the function of GLUT-4 protein?
(a) It acts as an intercellular ground substance.
(b) It acts against infectious agents.
(c) It acts as a sensory receptor.
(d) It enables glucose transport into cells.

89. Which one of the following hormones is secreted by pars intermedia?
(a) TSH (b) ACTH (c) FSH (d) MSH

90. Match column I with column II and select the correct answer from codes given below.

	Column I		Column II
A.	IgE	(i)	Skin
B.	Physical barrier	(ii)	Colostrum
C.	IgA	(iii)	Acid in stomach
D.	Physiological barrier	(iv)	Allergic reaction

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	(A)	(B)	(C)	(D)
(a)	(iv)	(i)	(ii)	(iii)
(b)	(iii)	(iv)	(i)	(ii)
(c)	(iv)	(iii)	(i)	(ii)
(d)	(iv)	(i)	(iii)	(ii)

91. Who initiated the Ganga Action Plan and Yamuna Action Plan to save the major rivers of our country from pollution?
(a) Ministry of Agriculture
(b) Ministry of Environment and Forests
(c) Ministry of Biodiversity
(d) Indian Agricultural Research Institute

92. Which of the following correctly defines vital capacity?
(a) Volume of air that will remain in the lungs after a normal expiration.
(b) Maximum volume of air a person can breathe in after a forced expiration.
(c) Total volume of air accommodated in the lungs at the end of a forced inspiration.
(d) Volume of air remaining in the lungs even after a forcible expiration.

93. The technology of biogas production was developed in India mainly due to efforts of
(a) IARI and KVIC (b) CSIR and KVIC
(c) IARI and CSIR (d) ICMR and IARI.

94. The ___A___ pairs of ribs do not articulate directly with the sternum but join the seventh rib with the help of ___B___ .

	A	B
(a)	5th, 9th, 10th	hyaline cartilage
(b)	8th, 9th, 10th	hyaline cartilage
(c)	3rd, 8th, 9th	sternum
(d)	8th, 9th, 10th	sternum

95. Exonuclease enzyme
(a) cuts at the specific position within the DNA
(b) remove nucleotides from the ends of the DNA
(c) remove nucleotides from the centre of the DNA
(d) adds nucleotides at the ends of the DNA.

96. In animals, ________ have ability to transform normal cell into cancerous cells.
(a) *Agrobacterium tumefaciens*
(b) *Salmonella typhimurium*
(c) *Escherichia coli*
(d) retroviruses

97. Which of the following is incorrectly matched?
(a) Pharynx - Common passage for food and air
(b) Larynx - Sound production
(c) Epiglottis - Prevents the entry of food into the glottis
(d) Trachea - Coiled structure

98. Which one of the following is the first restriction endonuclease?
(a) *Hind* II (b) *Eco*R I
(c) *Eco*R V (d) *Hind* III

99. Which one of the following statements is incorrect regarding Genetically modified organisms (GMO)?
(a) They are more tolerant to abiotic stress.
(b) They reduce the post-harvest losses.
(c) They reduce the nutritional value of food.
(d) They reduce the reliance on chemical pesticides.

100. Presence of glucose and ketone bodies in urine are the indicative of
(a) diabetes mellitus (b) uremia
(c) renal failure (d) renal calculi.

ANSWER KEY

1.	(a)	**2.**	(a)	**3.**	(a)	**4.**	(a)	**5.**	(d)
6.	(d)	**7.**	(a)	**8.**	(d)	**9.**	(c)	**10.**	(c)
11.	(a)	**12.**	(b)	**13.**	(b)	**14.**	(b)	**15.**	(d)
16.	(a)	**17.**	(a)	**18.**	(d)	**19.**	(b)	**20.**	(a)
21.	(c)	**22.**	(d)	**23.**	(d)	**24.**	(a)	**25.**	(b)
26.	(c)	**27.**	(d)	**28.**	(c)	**29.**	(a)	**30.**	(b)
31.	(a)	**32.**	(b)	**33.**	(a)	**34.**	(c)	**35.**	(a)
36.	(b)	**37.**	(a)	**38.**	(d)	**39.**	(c)	**40.**	(b)
41.	(d)	**42.**	(b)	**43.**	(b)	**44.**	(a)	**45.**	(a)
46.	(d)	**47.**	(d)	**48.**	(a)	**49.**	(b)	**50.**	(d)
51.	(d)	**52.**	(b)	**53.**	(d)	**54.**	(a)	**55.**	(c)
56.	(b)	**57.**	(a)	**58.**	(d)	**59.**	(a)	**60.**	(d)
61.	(a)	**62.**	(b)	**63.**	(c)	**64.**	(c)	**65.**	(a)
66.	(a)	**67.**	(a)	**68.**	(c)	**69.**	(a)	**70.**	(c)
71.	(b)	**72.**	(d)	**73.**	(a)	**74.**	(a)	**75.**	(d)
76.	(b)	**77.**	(d)	**78.**	(c)	**79.**	(a)	**80.**	(b)
81.	(a)	**82.**	(b)	**83.**	(a)	**84.**	(c)	**85.**	(c)
86.	(d)	**87.**	(a)	**88.**	(d)	**89.**	(d)	**90.**	(a)
91.	(b)	**92.**	(b)	**93.**	(a)	**94.**	(b)	**95.**	(b)
96.	(d)	**97.**	(d)	**98.**	(a)	**99.**	(c)	**100.**	(a)

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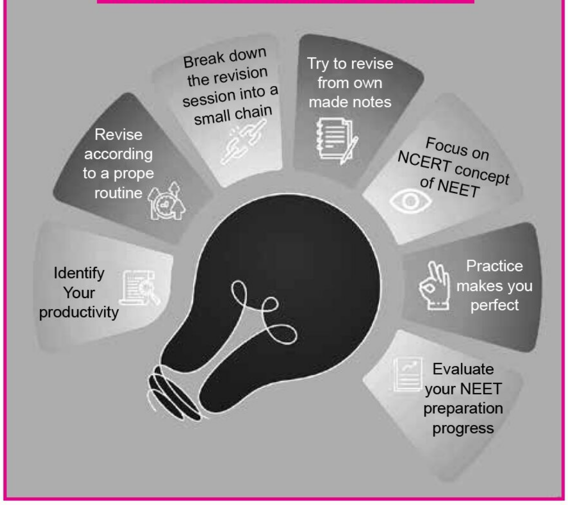
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PRACTICE PAPER 2023

CUET (UG)

Exam on
21^{st} to 31^{st}
May 2023

Section II of CUET (UG) is domain specific. In this section of Biology 40 questions to be attempted out of 50.

Time Allowed : 45 Minutes

Maximum Marks : 200

Section A

(All questions are compulsory.)

1. Which of the following statement(s) is/are true?

I. The hard outer layer exine is made up of sporopollenin.
II. The inner wall intine is a discontinuous layer made up of lignin.
III. Sporopollenin cannot withstand high temperatures, strong acids and alkali.
IV. Vegetative cell is small and floats in the cytoplasm of the generative cell.
V. Vegetative cell divides mitotically to produce two male gametes.

(a) Only II and IV (b) Only IV and V
(c) Only I (d) Only I, II and III

2. Match the microorganisms in column I with their commercial use in column II and choose the correct option.

	Column I		**Column II**
A.	*Propionibacterium shermanii*	(i)	CO_2 production
B.	*Penicillium notatum*	(ii)	Ethanol production
C.	*Saccharomyces cerevisiae*	(iii)	Immunosuppressive agent
D.	*Trichoderma polysporum*	(iv)	Antibiotic production

(a) A-(iii), B-(iv), C-(ii), D-(i)
(b) A-(iii), B-(iv), C-(i), D-(ii)
(c) A-(i), B-(iv), C-(ii), D-(iii)
(d) A-(i), B-(iv), C-(iii), D-(ii)

3. The reservoir for (i) exists in the atmosphere and for (ii) is located in earth's crust.

(a) (i) – sulphur cycle, (ii) – phosphorus cycle
(b) (i) – sulphur cycle, (ii) – nitrogen cycle
(c) (i) – phosphorus cycle, (ii) – sulphur cycle
(d) (i) – carbon cycle, (ii) – phosphorus cycle

4. Choose the correct sequence of primary succession in water. (P) Phytoplanktons, (Q) Reed-swamp stage, (R) Marsh-meadow stage, (S) Submerged plant stage, (T) Scrub stage, (U) Submerged free floating plant stage, (V) Forest

(a) P, S, U, Q, R, T, V (b) P, Q, R, S, T, U, V
(c) P, U, R, S, T, Q, V (d) P, S, U, R, Q, T, V

5. In Ti plasmid, Ti is the acronym of

(a) *Taq* induced
(b) tetracycline induced
(c) tumor inducing
(d) transformation inducing.

6. Match column I with column II and select the correct option from codes given below.

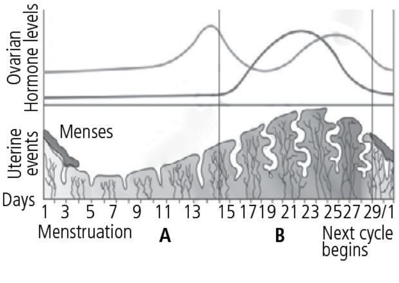
	Column I		**Column II**
A.	Autogamy	(i)	*Citrus*
B.	Albuminous seed	(ii)	Sea-grasses
C.	Polyembryony	(iii)	*Commelina*
D.	Water pollination	(iv)	Wheat

(a) A-(iii),B-(iv),C-(ii),D-(i) (b) A-(iii),B-(iv),C-(i),D-(ii)
(c) A-(ii),B-(iv),C-(i),D-(iii) (d) A-(i),B-(iv),C-(iii),D-(ii)

7. The salt concentration is measured as salinity in parts per thousand of different water bodies. Choose the correct option.

(a) <5 in sea
(b) >5 in the inland waters
(c) >100 in some hypersaline lagoons
(d) >100 in sea

8. Observe the given diagram of the menstrual cycle and select the option which correctly identifies A and B.



(a) A-Secretory phase, B-Ovulatory phase
(b) A-Proliferative phase, B-Luteal phase
(c) A-Luteal phase, B-Secretory phase
(d) A-Follicular phase, B-Ovulatory phase

9. MTP is considered relatively safe upto
(a) 24 weeks of pregnancy
(b) 2 weeks of pregnancy
(c) 20 weeks of pregnancy
(d) 12 weeks of pregnancy.

10. Select the mismatched pair from the following options.
(a) GIFT – Gamete intra fallopian transfer
(b) IUT – Intra uterine transfer
(c) ART – Assisted reproductive therapy
(d) ICSI – Intra cytoplasmic sperm injection

11. Read the given statements and select the correct option.
Statement I : Sickle-cell anaemia defect is caused by the substitution of valine by glutamic acid.
Statement II : In sickle-cell anaemia, the shape of RBCs changes from biconcave disc to elongated sickle like.
(a) Both statements I and II are correct.
(b) Both statements I and II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

12. What is common among Phenylketonuria, Thalassemia and Sickle-cell anaemia?
(a) All are autosome linked dominant disorder.
(b) All are autosome linked recessive disorder.
(c) All are sex linked recessive disorder.
(d) All are sex linked dominant disorder.

13. What of the following observations is correct *w.r.t.* Griffith's experiment?
(a) R strain → Inject into mice → Mice live
(b) S strain → Inject into mice → Mice live
(c) S strain (heat-killed) → Inject into mice → Mice die
(d) S strain (heat-killed) + R strain (live) → Inject into mice → Mice live

14. In capping and tailing, the residue added to the 5′ and 3′ respectively are
(a) ethyl guanosine triphosphate and adenylate
(b) ethyl guanosine diphosphate and adenylate
(c) methyl guanosine triphosphate and adenylate
(d) methyl guanosine diphosphate and adenylate.

15. Saltation is
(a) single step large mutation
(b) multiple step large mutation
(c) single step small mutation
(d) multiple step small mutation.

Section B

(Attempt any 25 questions.)

16. Identify the incorrect statement(s) regarding GEAC.
(a) They make safety rules regarding introducing GM-organisms for public services.
(b) It has been set up by the US Government.
(c) They make decisions regarding the validity of GM research.
(d) All of these

17. _______ is exhibited by the flying squirrel and flying phalanger.
(a) Convergent evolution (b) Divergent evolution
(c) Adaptive radiation (d) Both (a) and (c)

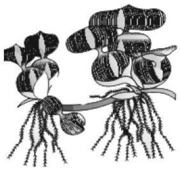
18. Match the following diseases with the causative organism and select the correct option.

	Column-I		Column-II
(A)	Typhoid	(i)	*Wuchereria*
(B)	Pneumonia	(ii)	*Plasmodium*
(C)	Filariasis	(iii)	*Salmonella*
(D)	Malaria	(iv)	*Haemophilus*

	(A)	(B)	(C)	(D)
(a)	(i)	(iii)	(ii)	(iv)
(b)	(iii)	(iv)	(i)	(ii)
(c)	(ii)	(i)	(iii)	(iv)
(d)	(iv)	(i)	(ii)	(iii)

19. Who showed that five closely related species of warblers living on the same tree were able to avoid competition and co-exist due to differences in their foraging patterns?
(a) Mac Arthur (b) Gause
(c) Darwin (d) Mendel

20. Which of the following reproduce by the vegetative propagule shown?



(a) Potato
(b) *Agave*
(c) *Bryophyllum*
(d) *Eichhornia crassipes*

21. Which microorganism is used as a blood-cholesterol lowering agent?
(a) *Trichoderma polysporum*
(b) *Clostridium butylicum*
(c) *Monascus purpureus*
(d) *Acetobacter aceti*

22. Match the hominids with their correct brain size.

(A)	*Homo habilis*	(i)	900cc
(B)	*Homo neanderthalensis*	(ii)	1400 cc
(C)	*Homo erectus*	(iii)	650-800cc

Select the correct option.

	(A)	(B)	(C)
(a)	(i)	(iii)	(ii)
(b)	(iii)	(i)	(ii)
(c)	(iii)	(ii)	(i)
(d)	(ii)	(iii)	(i)

23. Which peptide is not present in the mature insulin?
(a) A (b) B
(c) C (d) Both (a) and (b)

24. Transgenic models exist for which of the following human diseases?
(a) Rheumatoid arthritis (b) Alzheimer's disease
(c) Cystic fibrosis (d) All of these

25. Select the correct statement for human sperm.
(a) Mitochondria present in head produce energy for the movement of tail.
(b) Sperm head contains an elongated diploid nucleus.
(c) Sperms released from the seminiferous tubules are transported by the accessory ducts.
(d) Protein present in nucleus produces energy for the sperm motility.

26. Which microbe can flourish in hot springs?
(a) Archaebacteria (b) Eubacteria
(c) Cyanobacteria (d) *E.coli*

27. The given equation represents exponential growth. The value of e = the base of natural logarithm is

$$N_t = N_0 e^{rt}$$

(a) 3.818 (b) 2.818
(c) 3.718 (d) 2.718.

28. Which of the following points are not required for successful bee-keeping?
(a) Knowledge of the nature and habits of the bees.
(b) Selection of urban area for keeping the beehives.
(c) Catching and hiving of swarms.
(d) Management of beehives during different seasons.

29. The chromosome number in meiocyte is 34. The organism could be
(a) *Ophioglossum* (b) dog
(c) onion (d) apple.

30. Which of the following metals is fitted into automobiles for reducing the emission of poisonous gases?
(a) Cadmium (b) Rhodium
(c) Mercury (d) Copper

31. Read the given statements and select the correct option.
Statement I : *Pusa swarnim* is a variety of *Brassica.*
Statement II : *Pusa swarnim* has resistance to bacterial blight.
(a) Both statements I and II are correct.
(b) Both statements I and II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

32. The National Forest Policy (1988) of India has recommended forest cover for the plains is
(a) 33 % (b) 67 % (c) 44 % (d) 87 %.

33. What is the scientific name of carrot grass?
(a) *Lantana* (b) *Eichhornia*
(c) *Parthenium* (d) *Clarias gariepinus*

34. 'Competitive Exclusion Principle' was given by
(a) Darwin (b) G.F Gause
(c) Verhulst-Pearl (d) Mac Arthur.

35. Sacred groves are found in
(a) Khasi and Jaintia Hills in Meghalaya
(b) Aravalli Hills of Haryana

Huge chunk of plants, animals in US at risk of extinction, says new report

A leading conservation research group found that 40% of animals and 34% of plants in the United States are at risk of extinction, while 41% of ecosystems are facing collapse, according to a report released on 6th February 2023.

Everything from crayfish and cacti to freshwater mussels and iconic American species such as the Venus flytrap are in danger of disappearing.

NatureServe, which analyzes data from its network of over 1,000 scientists across the United States and Canada, said the report was its most comprehensive yet, synthesizing five decades worth of its own information on the health of animals, plants and ecosystems.

Importantly, the report pinpoints the areas in the US where land is unprotected and where animals and plants are facing the most threats.

Sean O'Brien, president of *NatureServe*, said the conclusions of the report were "terrifying" and he hoped it would help lawmakers understand the urgency of passing protections.

Encroachment by Humans

Among the species at risk of disappearing are icons like the carnivorous Venus flytrap, which is only found in the wild in a few counties of North and South Carolina.

Nearly half of all cacti species are at risk of extinction, while 200 species of trees, including a maple-leaf oak found in Arkansas, are also at risk of disappearing. Among ecosystems, America's expansive temperate and boreal grasslands are among the most imperiled, with over half of 78 grassland types at risk of a range-wide collapse.

California, Texas and the South-eastern US are where the highest percentage of plants, animals and ecosystems are at risk, according to the report.

Those areas are both the richest in terms of biodiversity in the country, but also where population growth has boomed in recent decades, and where human encroachment on nature has been harshest, said Wesley Knapp, the Chief Botanist *NatureServe*.

Courtesy : The Indian Express

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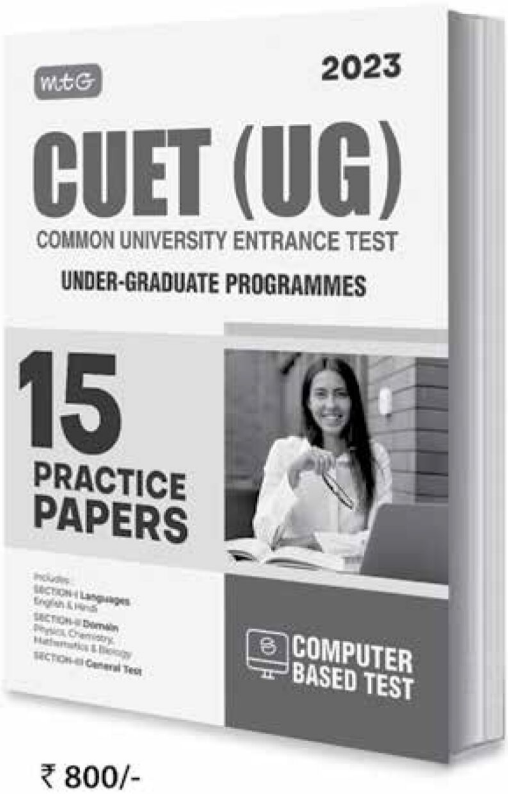

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(c) Western Ghat regions of Maharashtra
(d) both (a) and (c).

36. Identify the herbivore from the following.
(a) Grasshopper (b) Phytoplankton
(c) Wolf (d) Fishes

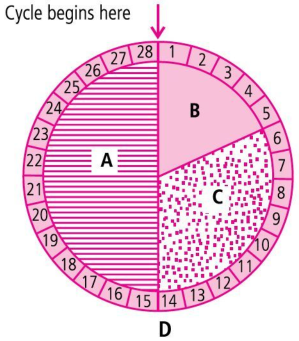
37. Read the following statements and select the incorrect ones.
(i) Bt toxin is produced by a bacterium called *Bacillus thuringiensis*.
(ii) Some strains of *Bacillus thuringiensis* can produce amino acids that kill certain insects.
(iii) Bt toxin exist as inactive protoxins in nature.
(iv) Genes *cry*IAc and *cry*II Ab control corn borer.
(v) Genes *cry*IAb controls cotton bollworms.
(a) (i), (ii) and (v) (b) (ii), (iii) and (iv)
(c) (ii), (iv) and (v) (d) (iii) and (v)

38. Single ovule in an ovary is not found in
(a) rice (b) orchids
(c) mango (d) wheat.

39. Read the given statements and select the correct option.
Statement I : During sewage treatment, bacteria produce a mixture of gases such as methane, zinc sulphide and carbon dioxide called biogas.
Statement II : Biogas plants are more often built in urban areas.
(a) Both statements I and II are correct.
(b) Both statements I and II are incorrect.
(c) Statement I is correct but statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

40. Contribution of 'methane' and 'CFCs' towards greenhouse effect is
(a) 20% and 6% (b) 14% and 6%
(c) 20% and 14% (d) 60% and 20%.

Case I : Given figure shows schematic representation of a menstrual cycle in human female. Identify it and answer the following questions from 41 to 45.



41. In which of the following phases Graafian follicle is ruptured?
(a) A (b) B (c) C (d) D

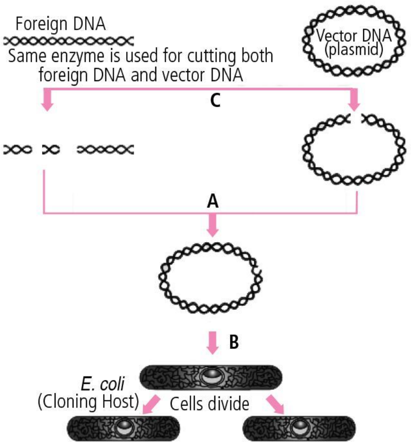
42. Which of the following hormones is/are produced in phase C?
(a) Estrogen (b) Progesterone
(c) LH (d) Both (a) and (c)

43. Which of the following events occur in phase B?
(a) Regeneration of endometrium
(b) Endometrial lining of uterus breakdown
(c) Rupture of Graafian follicle
(d) None of these

44. Hormone produced in phase A is secreted by
(a) zona pellucida (b) uterus
(c) corpus luteum (d) fallopian tube.

45. Regeneration of endometrium occurs in
(a) A (b) B (c) C (d) D.

Case II : Refer to the figure showing a technique and answer the following questions from 46 to 50.



46. Which technique is shown in given figure?
(a) Recombinant DNA technology
(b) DNA fingerprinting
(c) Electrophoresis
(d) Polymerase chain reaction

47. Which 'C 'enzyme is used in the first step of shown technique?
(a) Lysozyme (b) Restriction endonuclease
(c) DNA polymerase (d) RNA polymerase

48. Identify 'A'.
(a) Ligase (b) Exonuclease
(c) Dehydrogenase (d) Endonuclease

49. Which method of gene transfer 'B' is used in the given technique?
(a) Conjugation (b) Transposition
(c) Transduction (d) Transformation

50. What is the function of 'A'?
(a) It forms ester bond with the complementary cut counterparts.
(b) It removes nucleotides from the ends of the DNA..

(c) It joins the foreign DNA to the plasmid.
(d) It catalyses DNA replication.

SOLUTIONS

1. **(c)** **2.** **(c)** **3** **(d)**

4 **(a) :** In primary succession in water, the pioneers are the small phytoplanktons, which are replaced with time by rooted-submerged plants, rooted-floating angiosperms followed by free-floating plants, then reed swamp, marsh-meadow, scrub and finally the trees. The climax forest community is formed.

5. **(c) :** The tumor inducing plasmid (Ti plasmid) is used as a cloning vector in plants.

6. **(b)** **7.** **(c)** **8.** **(b)**

9. **(d) :** MTP *i.e.*, medical termination of pregnancy. MTPs are considered relatively safe during the first trimester, *i.e.*, upto 12 weeks of pregnancy.

10. **(c) :** ART stands for assisted reproductive technology. It is a technique performed when couples are unable to produce children inspite of unprotected sexual co-habitation.

11. **(d) :** Sickle-cell anaemia is an autosome linked recessive

The Millets Manifesto

What Govt could do to make 2023, International Year of Millets, truly a year for these 'nutri-cereals'

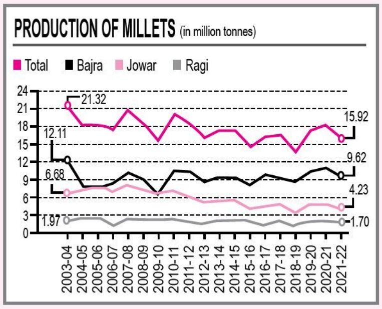
THE UNITED Nations has declared 2023 as the International Year of Millets. Since that was at the initiative of India, which also accounts for a fifth of the world's millets production, the Narendra Modi government would be expected to do something different this year to promote these "nutri-cereals"-going beyond just spreading awareness, or organising"special millets lunch" for parliamentarians and journalists.

The positives of millets

Millets score over rice and wheat in terms of minerals, vitamins, and dietary fibre content, as well as amino acid profile. Polished/white rice, for instance, contains only 2-4 mg/kg iron and 15-16 mg/kg zinc. Wheat has more of both-iron (37-39 mg/kg) and zinc (40-42 mg/kg) but its protein quality is poorer than even that of rice. Upto 80% of wheat's average 13% protein content comprises glutens, known to trigger gastrointestinal and autoimmune disorders in many people.

Bajra (pearl millet), on the other hand, has iron, zinc and protein levels comparable to that of wheat, but it's gluten-free and has more fibre. The *rotis* from *bajra* makes one feel fuller for longer, as they take more time to digest and do not raise blood sugar levels too fast.

The same nutritionally superior traits which significantly address the problem of "hidden hunger" arising from the consumption of energy dense but micronutrients-deficient foods are present in other millets too: jowar (sorghum), ragi (finger millet), kodo (kodo millet), kutki (little millet), kakun (foxtail millet), sanwa (barnyard millet), cheena (proso millet), kuttu (buckwheat) and chaulai (amaranth).



Nutritional advantages apart, millets are hardy and drought resistant crops. This has to do with their short duration (70-100 days, against 115-150 days for rice and wheat), lower water requirement (350-500 mm versus 600-1,250 mm) and ability to grow even on poor soils and in hilly terrain.

Where millets lag

However, millets aren't the first choice either of consumers or of farmers.

For the poor, both in urban and rural areas, rice and wheat were once aspirational foods. But thanks to the Green Revolution and the National Food Security Act of 2013, two-thirds of India's population receives, upto 5 kg of wheat or rice per person per month at Rs 2 and Rs 3/kg respectively. The Modi government has, in fact, made the issue of the two fine cereals free of cost from January 2023, further tilting the scales against millets.

Even for the better-off, rolling *rotis* is easier with wheat than millet flour. This is because the gluten proteins, for all their drawbacks, make the wheat dough more cohesive and elastic. The resultant breads come out light and fluffy, which isn't the case with *bajra* or *jowar*.

For farmers, low per-hectare yields – the National average is roughly 1 tonne for *jowar*,1.5 tonnes for *bajra* and 1.7 tonnes for *ragi*, as against 3.5 tonnes for wheat and 4 tonnes for paddy – are a disincentive. With access to assured irrigation, they would tend to switch to rice, wheat, sugarcane or cotton.

The Indian Agricultural Research Institute (IARI) has bred Pusa-1201, a hybrid *bajra* that gives an average grain yield of over 2.8 tonnes and potential of 45 tonnes per hectare. It matures in 78-80 days and is resistant to downy mildew and blast, both deadly fungal diseases. The grains have 13-14% protein, 55 mg/kg iron (normal level is 50 mg/kg) and 48 mg/kg zinc (normal: 35 mg/kg). But the absence of government procurement at minimum support price (MSP), unlike in paddy and wheat, would make farmers hesitant to grow even this high yielding and naturally bio-fortified *bajra*, suitable for both post-monsoon *kharif* (June-July sowing time) and summer (after harvesting of potato or mustard in in February-March and with 1-2 irrigations) cultivation.

The chart shows how millets have been reduced to "orphan crops" over the years, planted largely in marginal areas prone to moisture stress. Between 2003-04 and 2021-22, India's millet output has actually fallen from 21.32 million tonnes (mt) to 15.92 mt. Almost 98% of it is just three cereals – *bajra* (down from 12.11 mt to 9.62 mt), *jowar* (6.68 mt to 4.23 mt) and *ragi* (1.97 mt to 1.70 mt) – with small millets accounting for the rest (0.56 mt to 0.31 mt).

Courtesy : The Indian Express

defect. The defect is caused by the substitution of glutamic acid (Glu) by valine (Val) at the sixth position of the beta globin chain of the haemoglobin molecule.

12. (b) **13. (a)**

14. (c) : hnRNA (heterogeneous nuclear RNA) undergoes additional processing called as capping and tailing. In capping, an unusual nucleotide (methyl guanosine triphosphate) is added to the 5′-end of hnRNA. In tailing, adenylate residues (200-300) are added at 3′-end in a template independent manner.

15. (a)

16. (b) : The Indian Government has set up organisation such as GEAC (Genetic Engineering Approval Committee) which make decisions regarding the validity of GM research and the safety of introducing GM-organisms for public services.

17. (d) **18. (b)** **19. (a)**

20. (d) : *Eichhornia crassipes* (water hyacinth) uses offset as a vegetative propagule to develop new plants.

21. (c) : Statins produced by *Monascus purpureus* have been commercialised as blood-cholesterol lowering agents. It acts by competitively inhibiting the enzyme responsible for synthesis of cholesterol.

22. (c)

23. (c) : C peptide is not present in the mature insulin and is removed during maturation of insulin.

24. (d)

25. (c) : Human sperm is composed of a head, neck, middle piece and tail. Sperm head contains an elongated haploid nucleus. The middle piece possesses numerous mitochondria, which produce energy for the movement of tail that facilitate sperm motility essential for fertilisation.

26. (a) : Archaebacteria *i.e.*, ancient bacteria can flourish in hot springs.

27. (d)

28. (b) : Suitable location should be selected for keeping the bee hives.

29. (d)

30. (b) : Catalytic converters, have expensive metals namely platinum-palladium and rhodium as the catalysts, are fitted into automobiles for reducing emission of poisonous gases.

31. (c) : *Pusa swarnim* (Karan rai) is a variety of *Brassica* which is resistant to white rust.

32. (a) : According to National Forest Policy (1988) of India, 33 per cent forest cover for the plains and 67 per cent for the hills.

33. (c) **34. (b)**

35. (d) : Sacred groves are found in Aravalli Hills of Rajasthan.

36. (a)

37. (c) : Some strains of *Bacillus thuringiensis* can produce proteins that kill certain insects such as lepidopterans, coleopterans and dipterans. Genes *cry*IAC and *cry*IIAb control cotton bollworms whereas genes *cry*IAb controls corn borer.

38. (b) : The number of ovules in an ovary may be one (wheat, paddy, mango) to many (papaya, watermelon, orchids).

39. (b) : During sewage treatment, bacteria produce a mixture of gases such as methane, hydrogen sulphide and carbon dioxide. These gases form biogas and can be used as source of energy.

40. (c) : The gases which are transparent to solar radiation but retain and partially reflect back long wave heat (infrared) radiations are called greenhouse gases (GHGs). The various greenhouse gases are CO_2 (warming effect 60%), CH_4 (effect 20%), chlorofluorocarbons or CFCs (14%) and nitrous oxide (N_2O, 6%). Others of minor significance are water vapours and ozone.

41. (d) : D is ovulatory phase which is characterised by release of ovum due to rupture of Graafian follicle by LH surge.

42. (d) : C is follicular phase. In this phase, LH and FSH increases gradually and stimulates follicular development as well as secretion of estrogen by the growing follicles.

43. (b)

44. (c) : Corpus luteum secretes large amount of progesterone which is essential for maintenance of endometrium.

45. (c) **46. (a)**

47. (b) : C is restriction endonuclease which make cuts at specific positions within the DNA.

48. (a) : Sticky ends are joined together end-to-end using DNA ligase.

49. (d) : Transformation is a procedure through which a piece of DNA is introduced in a host bacterium.

50. (c)

☺☺

EXAM ALERT 2023

Exam	Date
WB JEE	30th April
NEET	7th May
CUET	21st to 31st May
MHT CET PCB	15th to 20th May
CBSE Class 12th	
CBSE Chemistry	28th Feb
CBSE Physics	6th March
CBSE Mathematics	11th March
CBSE Biology	16th March

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Bachelor of Science in Nursing (B.Sc Nursing) is a four-year undergraduate program followed by 6 months of mandatory internship. This course prepares candidates to serve humanity through medical treatment. Not only treating humanity, B.Sc nursing also imparts qualities of affection, care and patience in candidates towards the needy.

Job Perspectives

Learning is a never-ending process. Students who aim to polish their knowledge with quality information along with gaining some experience in practical work can go for higher Masters' or doctoral degrees.

After successfully completing the degree, aspirants can find employment opportunities in both the private and government sector. Nurses work as part of a team of professional and medical staff that includes doctors, social workers and therapists. B.Sc Nursing graduates can work as Nursing Assistant, Home Care Nurse, Ward Nurse, Infection Control Nurse, Nursing Tutor, Nurse Manager, Nursing Assistant Supervisor, Nursing Educator, Junior Psychiatric Nurse etc.

Nurses can expect to earn 2.5 - 3 lakhs as fresher and 5 - 6 lakhs per annum for over 5 years of experience.

Eligibility

- For getting admission in a B.Sc Nursing course, the basic eligibility criteria which every entrance exam and institute includes :
  - The minimum age of a candidate must be 17 years on the 31st December of the year of admission.
  - Candidate must have passed class 12th with minimum 50% in science stream with PCB and English as compulsory subjects.
  - Candidate should be medically fit.

Selection Criteria

For admission into a B.Sc Nursing course, students need to write the National or State-level entrance exams, apart from meeting the eligibility criteria. Some colleges conduct their own entrance test. The application form for B.Sc Nursing is mostly released between the months of April and June followed by the process of admission. Some of the B.Sc Nursing entrance exams are mentioned as follows :

- AIIMS
- BHU
- JIPMER
- AFMC Nursing
- MNS entrance exam(Indian Army B.Sc Nursing)
- PGIMER B.Sc Nursing
- All India Society for Electronics & Computer Technology [AISECT] University Entrance Exam (AUEE)

All those candidates who attempt B.Sc Nursing entrance exam at the state level will be asked to sit for the counselling session.

B.Sc Nursing Specialisations

- Industrial Nursing
- Public Health Nursing
- Military Nursing
- Orthopaedic Nursing
- Hospital Nursing
- Pediatric Nursing
- Home Health Nursing
- Psychiatric Nursing

Top Colleges offering B.Sc Nursing

(i) All India institute of Medical Science(AIIMS), New Delhi

(ii) Christian Medical College, Vellore

(iii) Guru Gobind Singh Indraprastha University, New Delhi

(iv) Armed Forces Medical College, Pune

(v) NIMS University, Jaipur

(vi) Lady Hardinge Medical College, New Delhi

(vii) Madras Medical college ,Chennai(Tamil Nadu)

(viii) **Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow**

(ix) Rajiv Gandhi University of Health Sciences, Bangalore

(x) Government Medical College, Nagpur

SGPGIMS Recruitment 2022

College Info

Sanjay Gandhi Postgraduate Institute Of Medical Sciences (SGPGIMS)
The College of Nursing at SGPGIMS Lucknow, an autonomous State University established by the SGPGIMS Act 1983, was established on 14th January 2008. SGPGIMS has secured 7th rank in the top medical institute category by NIRF 2022.

Sanjay Gandhi Postgraduate Institute offers B.Sc (Nursing) at UG level. The course duration of all the programmes is four years, comprising three academic years and one year of compulsory stipendiary internship.

Selection Criteria : Candidate must have passed Class 12 with PCBE subjects with minimum 50% aggregate (45% for reserved category). Final admission is based on the marks obtained in the entrance exam conducted by SGPGIMS, except for B.Sc Nursing, where a candidate will also have to clear counselling round to get admission.

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SCIENCE AND TECHNOLOGY

Micro LED Display

- The smartphone giant APPLE is shifting towards micro LED. The micro LEDs are self-illuminating diodes. Their colour production and illumination are brighter than organic LEDs. Their energy consumption is less, the image resolution is high, response time is less as compared to normal LEDs. Apple is planning to use micro LEDs in its future watch models.

Sarva Dawa Sevan

- Rajesh Bhushan, Health secretary, Union Health Ministry of health and welfare on February 10, 2023 launches nationwide '**Sarva Dawa Sevan**' or Mass Drug Administration campaign to eliminate **Lymphatic Filariasis** (a vector borne disease) through door-to-door administration of anti-filarial drugs especially in high-burden districts such as Bihar, Chhattisgarh, Jharkhand, Maharashtra, Uttar Pradesh, West Bengal, Karnataka, Odisha, Madhya Pradesh, and Andhra Pradesh.

iNCOVACC (BBV154)

- Bharat Biotech International Limited (BBIL) launched **iNCOVACC** (BBV154) on 26th January, 2023 the world's first intranasal vaccine for COVID-19. This vaccine is to be administered as a booster dose.

SSLV D2

- The second developmental flight of the **Small Satellite Launch Vehicle** (SSLV), SSLV-D2 was successfully launched on February 10, 2023, at 9:18 am from the first launch pad at Satish Dhawan Space Centre (SDSC) SHAR, Sriharikota. SSLV can carry a payload of up to 500 kg. It is one of the low-cost space crafts of ISRO, can carry more than one satellite, requires very less launch infrastructure, and provides very less turnaround time. SSLV-D2 will place the ISRO's earth observation satellite EOS-07 and two co-passenger satellites - Janus-1 and AzaadiSat2.

Snapdragon Satellite

- Qualcomm situated in san Diego, California in partnership with Iridium Inc. launched the first satellite-based two-way messaging called Snapdragon Satellite. The technology was introduced at last month's Consumer Electronics Show (CES) 2023.
- In two-way messaging like Whatsapp, both participants can send or receive messages simultaneously. But in one-way messaging apps offering SMS services, only one operation is possible.

Bal Mitra

- Dy CM Manish Sisodia (centre) launched Whatsapp Chatbot Bal Mitra of Delhi Commission for Protection of Child Rights on 1st February 2023. Along with a platform to report any matter related to the protection of child rights, this chatbot will also guide people, especially parents, on issues of admissions and education of their children. It will eliminate the gap of information between the government and citizens.
- Some of the chatbot's features include complaint registration, searching information and tracking complaint status, seeking information on admissions along with providing authentic information on various matters related to children and their rights.

Super Magnet

- Oxford-based Tokamak Energy has created a new generation of high temperature superconducting (HTS) magnets. It is being called the world's first super magnet. These "super" magnets that can be used for testing nuclear fusion power plants.
- The Demo4 magnet has a magnetic field strength that is nearly a million times stronger than the Earth's magnetic field, making it capable of confining and controlling the extremely hot plasma created during the fusion process.

- This technology uses up to five times less power than conventional super conducting magnets.

Quaoar

- Astronomers have spotted a ring around a dwarf planet called Quaoar in the outer reaches of the solar system.
- Quaoar is a dwarf planet that's located in the Kuiper Belt at the solar system's edge. It is about 697 miles wide (1,121 kilometers). It is roughly one-twelfth the diameter of Earth, one-third the diameter of the Moon, and half the size of Pluto. Its surface is moderately red and composed of low-density ice mixed with rock. It takes about 288 years for Quaoar to go once around the sun in a roughly circular orbit.

Test Yourself!

1. India's first human space mission "Gaganyaan" will be launched in which year?
(a) 2023 (b) 2024
(c) 2025 (d) 2026

2. Which company developed India's first 5G-enabled drone?
(a) Skylark Drones
(b) Teja Aerospace and Dynamics
(c) IG Drones
(d) Garuda Aerospace

3. In which state Satish Dhawan Space Centre located?
(a) Andhra Pradesh
(b) Uttar Pradesh
(c) Tamil Nadu
(d) Maharashtra

4. NISAR is a mission which map the entire earth in 12 days. What is NISAR stand for?
(a) Network In Space for Astronomical Radar
(b) New Indian Synchronised Aperture Radar
(c) NASA-ISRO Synthetic Aperture Radar
(d) NASA-ISRO Synthetic Astronomical Radar

5. ISRO SSLV-D2 mission, will place the earth observation satellite EOS-07 and two co-passenger satellites --------- , in a 450-km circular orbit around the Earth.
(a) Giant-1 and Arya2
(b) Janus-1 and AzaadiSat2
(c) James-1 and Kalam2
(d) Pro-1 and Navic2

6. Internal coating of high temperature super conducting magnets are made up of
(a) rare earth barium copper oxide
(b) rare earth palladium magnesium sulphide
(c) rare earth barium copper sulphate
(d) rare earth barium hydrogen sulfide.

7. Consider the following statements with respect to 'Sarva Dawa Sevan'.
I. It is a mission launched by Ministry of Housing and Urban Affairs.
II. This mission aims to eliminate lymphatic filariasis by 2027.
Which of the statement(s) given above is/are correct?
(a) I only (b) II only
(c) Both I and II (d) Neither I nor II

8. Which among the following is a WhatsApp chatbot launched by Delhi Commission for Protection of Child Rights?
(a) Meri Sakhi (b) Bachapan
(c) My Rights (d) Bal Mitra

9. Which one is the first scientific base station of India situated in Antarctica?
(a) Dakshin Gangotri (b) Maitri
(c) Bharati (d) Sanghi

10. How much approximately time Quaoar take to complete the full orbit around the Sun?
(a) 50 years (b) 400 years
(c) 100 years (d) 288 years

Answer Key

1. (b) **2.** (c) **3.** (a) **4.** (c) **5.** (b)
6. (a) **7.** (b) **8.** (d) **9.** (a) **10.** (d)

☺☺

SOLUTIONS TO FEBRUARY 2023 QUIZ CLUB

1. Madagascar
2. Thymus
3. Willi Hennig
4. Sartorius
5. Gills
6. Two
7. Yeast
8. Ultrasonic waves
9. Sodium
10. Termite
11. Bark
12. Diaphragm
13. Fats
14. Convex
15. J.Q. Plowe
16. Phytotron
17. Dropsy
18. Severe combined immunodeficiency (SCID)
19. Lateral meristem (Cambium)
20. Salivary gland
21. Cinchona
22. Gossamer
23. *Fagopyrum esculentum*
24. *Phytophthora intestans*
25. Abscisic acid (ABA)

Winner : *Isha Chauhan, (Madhya Pradesh)*

Quiz CLUB

Unlock Your Knowledge!

1. Which genus is responsible for causing lumpy skin disease in cattles?

2. Which cyanogenic glucoside is found in seeds of apple?

3. Which type of anesthetic is used for pain relief during labor?

4. How many bones are there in a new born baby?

5. What is the name of the most common colorblind deficiency test?

6. Which organ of human body remains same in size from birth till death?

7. Which type of vitamin is destroyed on heating?

8. Who is known as the Father of Dendrology in India?

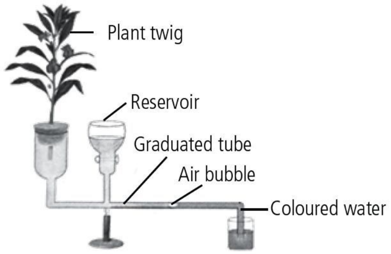
9. What is the name of the sugar found in milk?

10. Where is the stratum corneum located?

11. Name the phenomenon when androecium and gynoecium mature at different times in a bisexual flower.

12. Name the branch of science which deals with the study of causative agent of disease.

13 Name the instrument shown below which is used to measure the rate of evaporative loss of water in plants.



14. What is the name of oldest tree found in the eastern California?

15. Which mirror is used by doctors for examining eyes, ears, nose and throat?

16. Name the first stage of child's life as given by cognitive psychologist Jean Piaget.

17 In which year, Dr. Christian Barnard performed first human heart transplant on Louis Washkansky?

18. What is called toxemia of pregnancy?

19. The Bondla Wildlife Sanctuary (BWS) is located in which state?

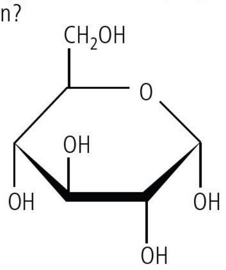
20 Which teeth of elephants are modified into tusks?

21. Who gave the method of radiocarbon dating?

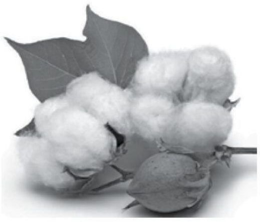
22. Which creature with an equine name have no teeth or stomach, mates for life, and is the only species on Earth where the male carries the unborn offspring?

23. Who was "Pratham", the first animal born in 1990 by the IVF (*In vitro* fertilisation) at the National Dairy Research Institute, Karnal?

24. How much energy is released by 1gm of the organic compound shown?



25. What is the scientific name of plant shown?



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Readers can send their responses at editor@mtg.in or post us with complete address by 10th of every month. Winners' names and answers will be published in next issue.

WORD GRID

Readers are requested to send their responses of word grid to be the winner.

Find and encircle the words in the given grid, running in one of the possible directions; horizontal, vertical or diagonal by reading the clues given below.

Clues

T	A	M	L	G	U	A	N	I	N	E	N	O	P	C
B	R	K	R	E	T	R	O	V	I	R	U	S	Q	O
C	H	A	I	N	G	K	P	R	P	O	L	Y	P	R
E	D	R	N	U	S	T	I	C	R	A	D	U	L	A
G	F	Y	S	S	W	V	O	P	O	R	I	N	A	L
F	L	O	C	S	F	X	I	K	T	N	O	P	S	Y
A	B	G	E	Z	Y	O	D	L	I	X	B	C	M	S
G	F	A	C	D	H	I	R	M	S	A	Y	Z	I	I
I	M	M	U	N	I	T	Y	M	T	D	E	F	D	N
A	E	Y	F	R	A	N	K	I	A	G	H	I	G	E
B	I	S	P	O	R	O	P	H	Y	T	E	K	L	U
F	O	X	Y	Z	M	O	R	T	A	L	I	T	Y	R
H	S	W	V	U	T	S	R	Q	P	O	N	O	H	O
J	I	C	C	O	M	P	E	T	I	T	I	O	N	N
M	S	D	E	G	I	K	L	N	O	P	Q	R	S	T

1. A cell division which reduces the chromosome number to half leading to production of haploid daughter cells.
2. All single cell eukaryotes having well defined nucleus and membrane bound organelles are placed under this kingdom.
3. The ability of body to fight against disease producing micro-organisms.
4. The process which involves the fusion of two nuclei.
5. A group of viruses that uses RNA as its genetic material.
6. The main plant body in pteridophytes, which is differentiated into true roots, stem and leaves.
7. These are masses of bacteria associated with fungal filaments to form mesh like structures.
8. It is free-living bacterium in soil, but fix atmospheric nitrogen as symbionts.
9. Autonomously replicating circular extra-chromosomal DNA.
10. A cnidarian having skeleton composed of calcium carbonate.
11. The number of deaths in the population during a given period of time.
12. An amino acid rich in histone proteins.
13. Protein that form large pores in the outer membrane of plastids, mitochondria and some bacteria.
14. An interaction in which both the species are negatively affected.
15. It is a file-like rasping organ for feeding in Phylum Mollusca.
16. A purine which is bonded with cytosine *via* three H-bonds.
17. A taxonomic category which comprise a group of related species.
18. Class of drugs extracted from latex of poppy plant which bind to specific receptors present in CNS and gastrointestinal tract.
19. Functional and structural unit of neural tissue that detects, receives and transmits different kinds of stimuli.
20. A procedure through which a piece of DNA is introduced in a host bacterium.

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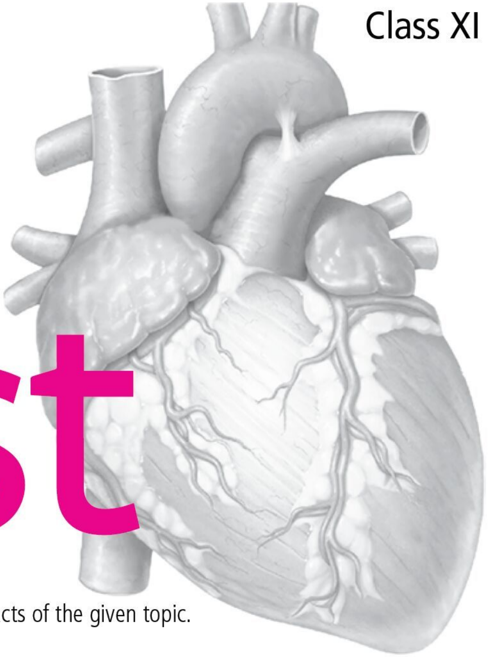
*Please send entries of solutions both with words and scanned copy of the grid within 10th of every month.

Class XI

BIO Digest



This article covers high yield facts of the given topic.

Body Fluids and Circulation

- Body fluid is any of the fluids found within animals, including blood, lymph, tissue fluid, urine, bile, sweat and synovial fluids.
- All living cells have to be provided with nutrients, oxygen and other essential substances.
- Complex organisms use special fluid within their bodies to transport such materials. Blood is the most commonly used body fluids by most of the higher organisms including humans. Lymph also helps in certain substances.
- Heart, blood, vessels are the three structural elements that make up the circulatory system.
- William Harvey first described the blood vascular system in man.

BLOOD

- Blood is a highly specialised mobile connective tissue composed of a fluid matrix, the plasma and formed elements or **blood corpuscles**, constituting approximately 8% of the body weight.
- Blood measures about 5-5.5 litres in an adult man constituting 30-35% of total extracellular fluid (ECF).
- It is slightly alkaline having pH 7.4. pH of blood in arteries is more than in veins.

Plasma

- Plasma is a fluid portion of the blood, slightly alkaline non-living intercellular substances which constitute about 55% part of blood. It represents 25% of the extracellular fluid (ECF).
- It is pale yellow but transparent and clear fluid.
- Plasma without clotting factors is called serum.
- Plasma protein albumin is required for osmotic balance, globulin for defence mechanism and fibrinogen for blood clotting.

Blood Corpuscles

- Erythrocytes, leucocytes and platelets are collectively called **blood corpuscles** or **formed elements**.
- They constitute nearly 45 per cent of blood.

Erythrocytes (Red Blood Cells)

- **Number:** A normal adult man and woman have about **5 and 4.5 million RBCs per microlitre** of blood respectively.
- An abnormal rise in RBC count is called **polycythemia**. Decrease in the number of RBCs is called **erythrocytopenia** which causes oxygen shortage in the blood and tissues.
- **Shape and Size:** The shape of RBCs vary in different classes of vertebrates. In all adult mammals, erythrocytes

are biconcave, circular and enucleated (non-nucleated). In camel and llama, RBCs are oval.

- Biconcave shape of RBCs provides more surface area for gaseous exchange than the spherical shape.
- **Colour:** The RBCs impart red colour to the blood due to the pigment **haemoglobin**.

Matured mammalian RBCs do not have cell organelles including nucleus, mitochondria, ribosomes, centrioles and endoplasmic reticulum. Thus, almost entire cytoplasm is filled with haemoglobin.

- **Life span:** The life span of RBCs is about 120 days.
- **Erythropoiesis:** Formation of RBCs is called erythropoiesis.
- **Function :** RBCs participate in transporting carbon dioxide from tissues to lungs.

Leucocytes (White Blood Cells)

- Leucocytes are colourless corpuscles as they lack haemoglobin.
- Nucleated, most active and motile constituent of blood and lymph. 6000-8000 of WBCs are present in each mL of blood.

Table : **Types of leucocytes**

Character	Neutrophils	Basophils	Eosinophils	Lymphocytes	Monocytes
Number	60-65%	0-1 %	2-3%	20-25%	2-10%
Nucleus	5-7 lobed	3 lobed (S-shaped)	Bilobed	Large rounded	Bean shaped
Function	Phagocytic, eat harmful germs and foreign particles	Release heparin, serotonin and histamine	Number increases in people with allergic reactions	Produce antibodies	Phagocytic in nature, engulf bacteria and cellular debris

Thrombocytes (Platelets)

- Platelets are cell fragments produced from megakaryocytes (special cells in the bone marrow).
- Blood normally contains 1,500,00-3,500,00 mm^{-3} platelets of blood. Normal life span of blood platelets is about a week.
- Platelets can release a variety of substances, most of which are involved in the coagulation or clotting of blood.
- A reduction in number of platelets can lead to clotting disorders, which results in excessive blood loss from the body.

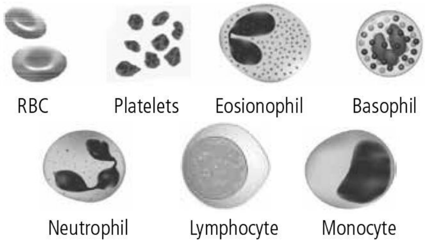


Fig.: Human blood corpuscles

Blood Group

- Blood of human beings differ in certain aspects though it appears to be similar.
- Antigens on the surface of red blood cells give rise to different blood groups.
- Various types of grouping of blood has been done. Two such grouping: the ABO and Rh are widely used all over the world.

ABO blood groups

- A, B and O blood groups were discovered by **Karl Landsteiner** (1900), while AB blood group was found out by **de Castello** and **Steini** (1902).
- ABO blood groups are determined by gene I, having three alleles I^A, I^B, I^O. Proteins produced by alleles I^A and I^B are called A antigen and B antigen respectively.
- Antigens are present on the surface of RBCs and their antibodies in plasma.

Table : **Human ABO blood groups and their compatibility**

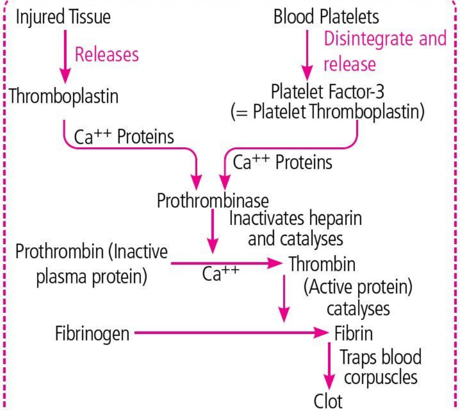
Blood group	Genotype	Antigens on red blood corpuscles	Antibodies in blood plasma	Can give blood to	Can get blood from
A	$I^A I^A$ or $I^A I^O$	A	b	A, AB	A, O
B	$I^B I^B$ or $I^B I^O$	B	a	B, AB	B, O
AB	$I^A I^B$	AB	None	AB	A, B, AB, O
O	$I^O I^O$	None	a, b	A, B, AB, O	O

Rh (Rhesus) blood group

- A protein named as **rhesus antigen**, is present on the surface of red blood corpuscles in many persons.
- It was discovered by **Landsteiner** and **Wiener** in the blood of **Rhesus monkey**, hence its name. Such individuals are called **Rh positive** (Rh^+) and those in whom this antigen is absent are called **Rh negative** (Rh^-). Rh^+ is dominant to Rh^-.
- Rh–ve person if exposed to Rh+ve blood, will form specific antibodies against the Rh antigens.

Coagulation of Blood (Blood Clotting)

- When an injury is caused to a blood vessel, bleeding starts which is stopped by a process called **blood clotting** or **blood coagulation**.
- Clotting time is the time required for blood to coagulate. It usually varies from 2 to 8 minutes.
- Vitamin K is essential for blood clotting because it is necessary for the synthesis of prothrombin in the liver. If vitamin K is not sufficient in the body, blood clotting becomes inefficient.



Flow chart : The process of blood clotting

CPD (Citrate-Phosphate Dextrose), ACD (Acid Citrate Dextrose) and EDTA (Ethylene-diaminetetraacetic Acid) are used by blood banks to prevent blood samples from clotting.

Functions of Blood

- Transports digested food from alimentary canal to different body cells.
- Transports oxygen from respiratory organs to tissues and carbon dioxide from tissues to respiratory organs.
- Transports hormones from endocrine glands to site of action.
- Maintains constant body temperature and regulates pH of the body.
- Transfers body heat from deeper tissues to body surface, where it can be lost.

Human Lymphatic System

Lymph

- It is colourless fluid, consists of plasma and leucocytes. It has fewer proteins and small amounts of nutrients and oxygen but abundant CO_2 and metabolic wastes.
- **Lymph plasma** is similar to that of blood but has fewer blood proteins, less calcium and phosphorus and high glucose concentration.
- **Lymph corpuscles** are floating amoeboid cells, the leucocytes, which are mostly lymphocytes. Erythrocytes and platelets are absent in lymph.

Blood Vessels

- Three types of blood vessels are – **arteries, veins** and **capillaries.**
- **Arteries** are elastic vessels that transport blood (oxygenated) away from the heart towards the body tissues.
- **Pulmonary artery** is the only artery which carries deoxygenated blood.
- **Veins** transport blood (deoxygenated) to the heart. **Pulmonary vein** is exceptional, conveys oxygenated blood from the lungs to the left atrium of the heart. Veins contain valves which prevent the back flow of blood.
- **Capillaries** are extremely small vessels located within the tissues of the body that transport blood from the arteries to the veins.

HUMAN CIRCULATORY SYSTEM

Human Heart

- Human heart is a mesodermally derived muscular organ present in the thoracic cavity. In between the two layers of pericardium, a **pericardial cavity** is present filled with **pericardial fluid** between the two lungs protected by double membrane of pericardium.
- The pericardium protects the heart from shocks and mechanical injuries and also allows free movement of the hearts.

Structure of Heart

External structure

- Human heart is **four-chambered**, consisting of two atria and two ventricles. The right and left atria are divided by an **interatrial** or **interauricular septum** and the right and left ventricles are separated by an **interventricular septum.**

Internal structures

Atrium

- The right atrium receives two large veins : **superior vena cava** and **inferior vena cava.** The superior vena cava brings deoxygenated blood from the head and upper region of the body. The inferior vena cava brings the deoxygenated blood from the lower region of the body.

MONTHLY TEST DRIVE CLASS XI ANSWER KEY

1.	(a)	**2.**	(b)	**3.**	(b)	**4.**	(d)	**5.**	(a)
6.	(c)	**7.**	(b)	**8.**	(a)	**9.**	(a)	**10.**	(b)
11.	(c)	**12.**	(a)	**13.**	(b)	**14.**	(b)	**15.**	(d)
16.	(a)	**17.**	(a)	**18.**	(a)	**19.**	(d)	**20.**	(b)
21.	(b)	**22.**	(d)	**23.**	(c)	**24.**	(a)	**25.**	(c)
26.	(a)	**27.**	(b)	**28.**	(a)	**29.**	(c)	**30.**	(b)
31.	(a)	**32.**	(c)	**33.**	(b)	**34.**	(d)	**35.**	(c)
36.	(c)	**37.**	(a)	**38.**	(a)	**39.**	(d)	**40.**	(d)

The left atrium receives oxygenated blood from lungs *via* pulmonary veins.

Ventricle

- **Left ventricle is thicker than the right ventricle** because it has to push blood to all the body parts at a much greater pressure.
- The valve separating the left atrium and the left ventricle is called the **bicuspid valve** or **the mitral valve.**
- The valve separating the right atrium from the right ventricle is known as the **tricuspid valve.**
- **Chordae tendineae** are the special fibrous cords attached to the flaps of biscuspid and tricuspid valves and are joined to the other ends with the **papillary muscles.**
- **Semilunar valves** (pulmonary valve and aortic valve) are present where arteries (pulmonary trunk and aorta) leave the heart. The valves of the heart maintain unidirectional flow of blood and prevent its regurgitation in the opposite direction.

Heartbeat

- Heartbeat is the rhythmic contraction and relaxation of the heart. Each heart beat includes one **systole** (contraction phase) and one **diastole** (relaxation phase) of the heart to distribute and receive blood to and from the body.
- The heart of a healthy person beats 72 times per minute (average).

Pulse and Heart Rate

- Pulse is the alternate expansion and elastic recoil of an artery with each systole. It is the strongest in the arteries closest to the heart. Therefore, it is also called as arterial pulse. Normal pulse rate ranges from 70–90 beats per minute.
- Pulse per minute is called as heart rate. Human heart beats **72 times per minute,** this is designated as heart rate. It increases during exercise, fever, anger and fear.

Tachycardia – Heartbeats rapidly
Bradycardia – Heartbeats slowly

CARDIAC OUTPUT

- Cardiac output is the volume of blood flowing through either the systemic or the pulmonary circuit per minute.
- It is determined by multiplying the heart rate with the volume of blood ejected by each ventricle during each beat, which is called the **stroke volume**.
- Cardiac output = Heart rate × Stroke volume = 72 beats/min. × 0.07 litre/beat = **5.0 litres/min.**
- During periods of strenuous exercise in well-trained athletes, the cardiac output may reach 35 L/min; the entire blood volume is pumped around the circuit seven times a minute.

CARDIAC CYCLE

- The sequence of events, which occur from the beginning of one heartbeat to the beginning of next heartbeat. It has two phases - contraction phase (systole) and relaxation phase (diastole). Its duration is 0.8 sec.
- The successive stages of the cardiac cycle are briefly described as :

(i) **Atrial systole :** The atria contract due to a wave of contraction, stimulated by the SA node. The blood is forced into the ventricles as the bicuspid and tricuspid valves are open.

(ii) **Beginning of ventricular systole :** The ventricles begin to contract due to a wave of contraction, stimulated by the AV node. The bicuspid and tricuspid valves close immediately producing part of the first heart sound.

(iii) **Complete ventricular systole :** When the ventricles complete their contraction, the blood flows into the pulmonary trunk and aorta as the semilunar valves open.

(iv) **Beginning of ventricular diastole :** The ventricles relax and the semilunar valves are closed. This causes the **second heart sound**.

(v) **Complete ventricular diastole :** The tricuspid and bicuspid valves open when the pressure in the ventricles falls and blood flows from the atria into the ventricles. Contraction of the heart does not cause this blood flow. It is due to the fact that the pressure within the relaxed ventricles is less than that in the atria and veins.

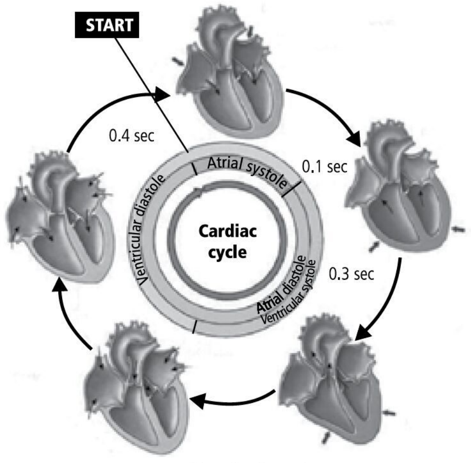


Fig. : Cardiac cycle

HEART SOUND

- Heart sounds are produced twice during each cardiac cycle.
- **First heart sound :** Due to closure of the mitral and tricuspid valves immediately after the start of the ventricular systole.
  - L-U-B-B
  - Longer duration (0.16–0.90 sec and frequency of 25–45 Hz)
  - Low pitched and less loud.
- **Second heart sound :** Due to closure of the aortic and semilunar valves at the end of the ventricular systole.
  - D-U-B
  - Shorter duration (0.10 sec and frequency of 50 Hz)
  - High pitched and louder.
- Heart sound can be heard by **stethoscope**.

Electrocardiogram (ECG)

- It is the recording of electric potential generated by the spread of cardiac impulse. It is a graphic record of the electric current produced by the excitation of cardiac muscle.
- The **P Wave** is a small upward wave that represents electrical excitation or the **atrial depolarisation** which leads to contraction of both the atria (atrial contraction). It is caused by the activation of SA node.

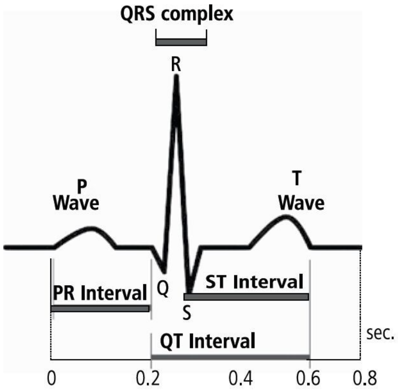


Fig.: A graphic representation of a normal ECG

- The **QRS Wave (complex)** represents **ventricular depolarisation** (ventricular contraction). It is caused by the impulses of the contraction from AV node through the bundle of His and Purkinje fibres and the contraction of the ventricular muscles.
- The **T Wave** is dome-shaped which represents **ventricular repolarisation** (ventricular relaxation). The end of the T-wave marks the end of systole.

INTEXT PRACTICE QUESTIONS

1. **Who reported first the ABO blood groups in human beings?**
2. **What is the life span of RBCs?**
3. **Which vitamin is essential for blood clotting?**

DOUBLE CIRCULATION

- The blood is received and pumped in a single cardiac cycle, so is termed as **double circulation**. It follows two pathways :
- **Systemic circulation :** The system of blood vessels that ensures the supply of oxygenated blood from the left ventricle to all the body organs and return of deoxygenated blood to the right atrium is the systemic circulation. The main purpose of such a circulation is to transport oxygen, as well as nutrients to the body tissues and to remove carbon dioxide and harmful nitrogenous wastes from them.
- **Pulmonary circulation :** The flow of deoxygenated blood from the right ventricle to the lungs *via* pulmonary arteries and return of oxygenated blood from lungs to left atrium by pulmonary veins is called pulmonary circulation.

WHO AM I ...

"I am the blood volume flowing through either the systemic or pulmonary circuit per minute."

...search me ☺

Significance of double circulation

- In this type of circulation there is no mixing of the oxygen rich blood and oxygen poor blood in the heart. Oxygenated blood carries more oxygen to different body parts as well as more CO_2 is carried with deoxygenated blood for the removal through lungs.

Circulation Through Special Regions

Coronary circulation

- The flow of oxygenated blood from the ascending aorta to the heart muscle and the return of deoxygenated blood from the heart muscle to the right atrium is called coronary (cardiac) circulation.
- The coronary veins bring deoxygenated blood to the coronary sinus.

Hepatic portal circulation

- It is flow of deoxygenated blood from the digestive organs to the liver before returning to the heart. Excess glucose present in absorbed food is converted into glycogen in liver, which is stored for later use during deficiency of food.

REGULATION OF CARDIAC ACTIVITY

- Normal activities of the heart are autoregulated by specialised muscles (nodal tissue), hence the heart is called **myogenic**. A special neural centre in the medulla oblongata can moderate the cardiac function through autonomic nervous system (ANS).
- Sympathetic nervous system constricts arteries, that raises blood pressure and thus, accelerates heart beat.
- Parasympathetic nervous system dilates arteries, which lowers blood pressure and slows hear tbeat.
- Adrenal medullary hormones (Epinephrine and Nor-epinephrine) increase the heart beat.

DISORDERS OF CIRCULATORY SYSTEM

Hypertension

- It is the most common disease affecting the heart and blood vessels. A blood pressure of 120/80 mmHg is considered normal. But the increase in blood pressure beyond 140 mmHg (systolic) and 90 mmHg (diastolic) is called high blood pressure (hypertension). High blood pressure can harm heart, brain, kidneys and eyes.

Angina pectoris

- This chest (anginal) pain usually starts in the centre of the chest and spreads down the left arm. The chest pain may be associated with restlessness, fear or anxiety, a pale skin, profuse sweating and vomiting (all because of increased adrenergic discharge). The pain lasts for only a few moments.

Heart failure (congestive heart failure)

- It is a collection of signs and symptoms that occur when the heart fails to pump an adequate cardiac output. Heart failure is not the same as **cardiac arrest** (when the heart stops beating) or **heart attack** (when the heart muscle is suddenly damaged by inadequate blood supply).

Ebstein's disease

- It is a congenital downward **displacement of the tricuspid valve** into the right ventricle.

Atherosclerosis /Coronary Artery Disease (CAD)

- It is the deposition of lipids (cholesterol) on the wall lining the lumen of arteries called **atheromatous** or **atherosclerotic plaque**. These plaques may completely block the artery. Such plaques, if formed in the coronary artery, reduce the blood supply to the heart and may result in heart attack or stroke.

INTEXT PRACTICE QUESTIONS

4. **Which valve opens during ventricular systole?**
5. **Where is cardiac centre located?**
6. **Define double circulation.**

Excretory Products and their Elimination

EXCRETION

- Animals accumulate various kinds of metabolic wastes and depending upon the excretory products, the mode of excretion of these substances vary among them.
- **Excretion** is the process of elimination of waste products and nitrogenous by-products of metabolism. Through excretion, organisms control osmotic pressure, *i.e.*, balance between inorganic ions and water and maintain acid-base balance. The process thus, promotes homeostasis which is vital for normal life processes.
- Ammonia, urea, uric acid, xanthine, guanine, trimethylamine oxide, ornithuric acid, hippuric acid, creatinine, etc., are types of nitrogenous waste products.

Modes of Excretion

- Based on excretory products, there are three main categories of animals.

Ammonotelic animals

- Most teleost fish (modern bony fishes), tadpoles and aquatic insects excrete nitrogenous wastes as ammonia. This phenomenon is referred to as **ammonotelism** and the concerned animals are called **ammonotelic.** Ammonia molecules are readily soluble in water, so they easily cross the membrane barriers.
- Urea formed in the liver is transported to kidney for excretion in urine.

Ureotelic animals

- Mammals, most adult amphibians living on land and many marine fishes and turtles, which face the problem of conserving water in their hypertonic environment excrete nitrogenous wastes as urea and the concerned animals are called **ureotelic** and this phenomenon that helps to loose less water while disposing of the nitrogenous wastes is known as **ureotelism**.

Formation of urea

- Urea is the end product of protein metabolism formed by a cyclic process known as **ornithine cycle** or **Krebs-Henseleit cycle** in the liver.

Uricotelic animals

- **Uric acid excretion** or **uricotelism** enables terrestrial animals to excrete nitrogenous wastes of metabolism with a minimum loss of water. Uric acid is less soluble in water than either ammonia or urea. It can be excreted as a precipitate, after reabsorbing nearly all the water from the urine. Land snails, insects, birds and many reptiles are uricotelic and excrete uric acid.

Table: **Excretory structures/organs of different animals**

	Animal groups	Main excretory structures/organs
(i)	Protozoans	Plasmalemma or general body surface
(ii)	Porifera and cnidaria	Plasma membrane of each cell
(iii)	Platyhelminthes (*Planaria*, liver fluke, tapeworm)	Protonephridia or flame cells or solenocytes
(iv)	Aschelminthes (Roundworms)	H-shaped renette cell
(v)	Annelids (*Nereis*, earthworm, leech)	Nephridia
(vi)	Arthropods (Insects)	Malpighian tubules
(vii)	Crustaceans (Prawn)	Antennary or green glands
(viii)	Spiders	Coxal glands
(ix)	Molluscs (*Unio*)	Tubular nephridia organised like kidneys
(x)	Vertebrates	One pair of kidneys

HUMAN EXCRETORY SYSTEM

- In humans, excretion takes place through a well developed system of organs called **urinary system**. The human excretory system includes a pair of kidneys, a pair of **ureters**, a **urinary bladder** and **urethra**.

Kidneys

- There is a pair of dark red, bean shaped kidneys, each with a notch called **hilus**, from where blood vessels, lymph vessels, nerves and ureter enter or leave the kidney.

Location

- They are located in upper dorsal region of abdominal cavity, on either side of vertebral column and are protected by floating ribs.
- The right kidney is slightly lower than left kidney because of the liver.

Structure

- Fibrous connective tissue layer, called **renal capsule** covers the kidney and protects it from infection and injuries.
- Renal capsule is surrounded by **adipose capsule** and another outer fibrous membrane, **renal fascia**. Both the layers protect the kidneys.
- Inner to renal capsule is outer dark reddish **cortex** and inner pale **medulla**.
- **Inner medulla** contains 10-15 medullary pyramids, which terminate into renal papilla.

TRIO

ANSWERS FEBRUARY 2023

The three letter word is **E R O**.

ANTH**E**R**O**ZOID

HET**E**R**O**THALLIC

ST**E**R**O**ID

PROGEST**E**R**O**NE

Winner : Asmita Dam (West Bengal)

- Papillae projects into ‘**calyces**’, such 10-15 minor calyces join to form **major calyces** (2-3) which come out through pelvis of kidney to the widened end of the ureter.
- Kidney is mesodermal in origin.

Nephron

- Nephrons are the basic functional units of kidney. There are approximately 1-1.3 million nephrons in each kidney which drain into renal pelvis. The total length of nephron ranges from 45-65 mm. It consists of two parts: **Malpighian corpuscle** and a **renal tubule**.

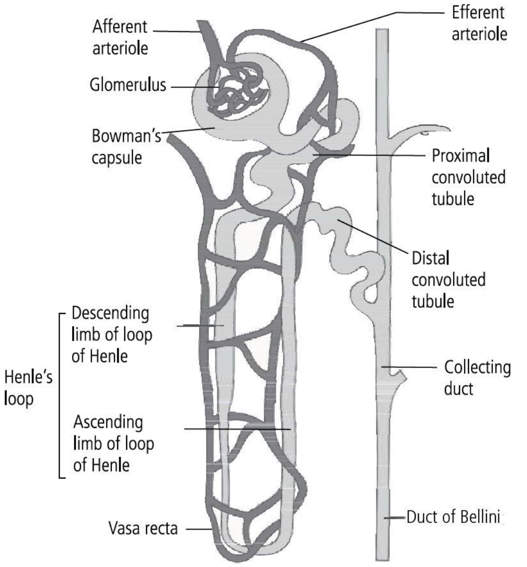


Fig.: Structure of a nephron showing blood vessels, ducts and tubules

Renal corpuscle or Malpighian corpuscle

- It comprises of glomerulus and Bowman’s capsule.
- Glomerulus is a tuft of capillaries formed by the afferent arteriole, a fine branch of renal artery through which blood enters glomerulus. Blood from the glomerulus is carried away by an **efferent arteriole**, which further forms vasa recta and drains into the renal vein.
- Glomerular membrane has three layers; the endothelium of glomerular blood vessels, basement membrane and epithelium of Bowman's capsule.
- Epithelium possess podocytes, which have special processes called **pedicels**. The space between pedicels is slit pores, through which glomerular filtrate filters.
- The renal tubule has a double walled cup-like structure called **Bowman’s capsule**, which encloses the glomerulus.

Renal tubule

- The tubule continues further to form a highly coiled network called **proximal convoluted tubule** (PCT). The cells of the proximal convoluted tubule have numerous **brush bordered microvilli**, which increase the surface area and **mitochondria,** which provide energy for reabsorption of salts by **active transport**.
- A hairpin shaped **Henle’s loop** is the next part of the tubule which has a **descending** and an **ascending limb**. Descending limb of loop of Henle is relatively thin and long. It is lined with **squamous epithelial cells**; however, the cells possess sparse microvilli and fewer mitochondria.
- **Ascending limb of loop of Henle** is comparatively thicker and is composed of flattened **cuboidal epithelium**.
- The ascending limb continues as another highly coiled tubular region called **distal convoluted tubule** (DCT). The DCTs of many nephrons open into a straight tube called **collecting duct,** many of which converge and open into the **renal pelvis** through **medullary pyramids** in the **calyces.**

Types of Nephron

- The Malpighian corpuscle, PCT and DCT of the nephron are situated in the cortical region of the kidney, whereas the loop of Henle dips into the medulla. In majority of nephrons, the loop of Henle is too short and extends only very little into the medulla. Such nephrons are called **cortical nephrons** and are about 85% of the total nephrons. In some of the nephrons, the loop of Henle is very long and runs deep into the medulla. These nephrons are called **juxtamedullary nephrons** and are about 15% of the total nephrons.

Functions of Kidney

- It removes nitrogenous wastes (urea and uric acid), excess water, acidic substances and maintains the osmotic pressure and pH of the body fluid (**fluid homeostasis**) from the blood.
- It regulates proper amount of mineral salts, (such as sodium and potassium) and water content in the body (osmoregulation).
- It eliminates toxic substances, such as, drugs, pigments, excess vitamins from the blood.
- The kidney produces erythropoietin which stimulates the formation of red blood corpuscles.

WHO AM I ...

“I am a hormone that increases sodium excretion, inhibits renin secretion by juxtaglomerular cells and regulates the functions of kidneys.”

...search me ☺

Ureter

- It is a narrow, tubular structure, lined with transitional epithelium. It carries urine from kidneys to urinary bladder.

Urinary Bladder

- It is a pear shaped, muscular, sac-like structure present in pelvic cavity. Its inner lining is lined with transitional epithelium.

Urethra

- The canal-like structure which extends from neck of the bladder and leads to exterior is known as **urethra**.

URINE FORMATION

- Urine formation involves three main processes: **glomerular filtration, tubular reabsorption** and **tubular secretion**.

Glomerular Filtration (Ultrafiltration)

- The first step in urine formation is filtration of blood. On an average, 1100-1200 mL of blood is filtered by kidneys per minute.
- The glomerular capillaries are narrower than the afferent renal arterioles. Therefore, the blood pressure in the glomerular capillaries becomes very high so that there is continuous process of ultrafiltration (filtration under pressure) through the semi-permeable glomerular capillaries. Thus, water and many dissolved substances from the blood are filtered into the lumen of the Bowman's capsule through its walls.
- The amount of the filtrate formed by the kidneys per minute is called glomerular filtration rate (GFR). GFR in a healthy individual is approximately 125 mL/min, *i.e.*, isolitres per day.
- The **glomerular filtrate** contains a large amount of water and other dissolved substances such as urea, uric acid, creatinine, amino-acids, glucose, sodium, potassium, vitamins, etc. The blood flows into efferent renal arterioles. Thus, the glomerular filtrate and blood plasma are similar except that glomerular filtrate does not have proteins and fats.

Regulation of glomerular filtration rate

- The kidneys have built-in mechanism for the regulation of glomerular filtration rate. Juxtaglomerular apparatus (JGA) performs this efficient mechanism. JGA is a special sensitive region formed by cellular modifications in the distal convoluted tubule and the afferent arteriole at the location of their contact. A fall in GFR can activate the JG cells to release renin which can stimulate the glomerular blood flow and so thereby GFR back to normal.

Tubular Reabsorption

- Glomerular filtrate enters proximal convoluted tubule (PCT) from the Bowman's capsule. Tubular reabsorption is absorption of selected materials from the filtrate into blood of peritubular capillaries or vasa recta.
- Reabsorption involves both **passive** and **active transport** across the tubular epithelium.
- Tubular reabsorption of major substances in different parts of tubule are :

(i) Proximal convoluted tubule

- 65% of glomerular filtrate is reabsorbed in PCT.
- **Maintains the pH** and ionic balance of body fluids by selective secretion of hydrogen ions and ammonia into the filtrate and by absorption of HCO_3^- from it.
- **Sodium and potassium** are reabsorbed by primary active transport (energy derived from ATP or other high energy phosphate compound).
- **Glucose** and **amino acids** are reabsorbed by secondary active transport (energy is derived from ionic concentration gradients). **Water** is reabsorbed by osmosis. **Chloride ions, urea** and other solutes are reabsorbed by diffusion.
- The filtrate becomes **isotonic** to blood plasma.

(ii) Loop of Henle

Reabsorption in this segment is minimum, it plays role in maintenance of high osmolarity of medullary interstitial fluid. It is further divided into two types:

(a) Descending limb

- Permeable to water and almost impermeable to electrolytes.
- Water from filtrate is reabsorbed, but sodium and other solutes are not reabsorbed here. The filtrate thus, becomes **hypertonic** to blood plasma.

(b) Ascending limb

- Impermeable to water but permeable to K^+, Cl^- and Na^+ and partially permeable to urea.
- As concentrated filtrate pass upward, it gets diluted due to passage of electrolytes to medullary fluid.
- Filtrate thus, becomes **hypotonic** to blood plasma.

(iii) Distal convoluted tubule

- There is active reabsorption of sodium ions from the filtrate (under the influence of aldosterone) and water (under the influence of antidiuretic hormone [ADH]).
- Filtrate becomes **isotonic** to blood plasma.

(iv) Collecting duct

- The entire duct is permeable to water, thus considerable amount of water is reabsorbed here, under the influence of ADH which makes filtrate hypertonic to blood plasma.
- Sodium is reabsorbed under the influence of aldosterone. The filtrate is now called **urine.** Thus, urine is **hypertonic** to **blood** and **isotonic** to **medullary fluid**.

Tubular Secretion

- It is opposite of tubular reabsorption. It involves the removal of selected materials from the nephric filtrate into the blood of the peritubular blood capillaries.
- The removal of ammonia, urea, uric acid, creatine, creatinine, hippuric acid, etc., from the blood into the filtrate takes place by secretion.
- Secretion of ammonia, potassium, hydrogen and HCO_3^- ions into the filtrate in distal convoluted tubule takes place by active transport only. Removal of H^+ and ammonia from the blood into the tubule maintains the pH of blood (6-8).

INTEXT PRACTICE QUESTIONS

7. Name the main excretory organ of earthworm.

8. Define ureotelism. Give two examples.

9. Which part of loop of Henle is permeable to water and almost impermeable to electrolytes?

COUNTER CURRENT MECHANISM

- The kidneys possess a special mechanism for concentrating the urine, called counter current mechanism. Since the flow of filtrate in two limbs of loop of Henle is in opposite direction, it forms a counter current.
- The main function of counter current mechanism is to concentrate NaCl in interstitial fluid thereby causing water to diffuse out of collecting ducts. As a result, **hypertonic urine** is produced.
- This mechanism depends on the **loop of Henle**, **vasa recta**, **collecting ducts** and **interstitial fluid**.
- The proximity between the **loop of Henle** and **vasa recta,** as well as the counter current in them help in maintaining an increasing osmolarity towards the inner medullary interstitial fluid, *i.e.*, from 300 mOsmolL^{-1} in the cortex to about 1200 mOsmolL^{-1} in the inner medulla. This gradient is mainly caused by **NaCl** and **urea.**
- NaCl is transported by the ascending limb of loop of Henle which is exchanged with the descending capillary of vasa recta. NaCl is returned to the medullary interstitial fluid by the ascending capillary of vasa recta.
- Small amounts of urea enter the thin segment of the ascending limb of loop of Henle which is transported back to the medullary interstitial fluid by the collecting duct.

- The counter current mechanism helps to maintain a concentration gradient in the medullary interstitial fluid which helps in an easy absorption of water from the filtrate present in the collecting duct. This increases the concentration of the filtrate (urine). Human kidneys can produce about four times concentrated urine than the initial filtrate formed.

REGULATION OF KIDNEY FUNCTION

- The functioning of the kidneys is efficiently monitored and regulated by hormonal feedback mechanisms involving the hypothalamus, JGA and to a certain extent, the heart.
- **Osmoreceptors** in the body are activated by changes in blood volume, body fluid volume and ionic concentration.

Control by Antidiuretic Hormone (ADH)

- An excessive loss of fluid from the body can activate osmoreceptors which stimulate the hypothalamus to release ADH from neurohypophysis.
- ADH facilitates water reabsorption from latter parts of tubule, thereby preventing diuresis.
- Increase in body fluid volume can switch off the osmoreceptors and suppress the ADH release to complete the feedback.

Control by Juxtaglomerular Apparatus (JGA)

- As blood pressure decreases, the cells of the **juxtaglomerular apparatus** release the enzyme **renin** and activate the **renin-angiotensin-aldosterone system (RAAS).**
- Renin converts **angiotensinogen** into **angiotensin I**. **Angiotensin converting enzyme (ACE)** then converts **angiotensin I** into **angiotensin II**, a peptide hormone that is the active form.
- Angiotensin II has the following effects:
  - Raises blood pressure directly by constricting blood vessels (being powerful vasoconstrictor).
  - Increases the synthesis and release of aldosterone.
  - Aldosterone causes sodium and water reabsorption by the distal part of the tubules. This also leads to an increase in blood pressure and GFR.
  - Stimulates the posterior pituitary to release ADH.
  - These changes assist in restoring extracellular fluid volume and in stabilising blood pressure.
- **ACE inhibitors** are sometimes administered to block the production of angiotensin II in persons with elevated blood pressure.

Control by Atrial Natriuretic Factor (ANF)

- ANF opposes the regulation by RAAS. The walls of the atria of the heart release ANF in response to an increase in blood volume and pressure. ANF inhibits release of renin from the

JGA and thereby inhibits NaCl reabsorption by the collecting duct and reduces aldosterone release from the adrenal gland. Thus, ADH, RAAS and ANF regulate the functions of kidneys. As a result, they control body fluid osmolarity, salt concentration, blood pressure and blood volume.

MICTURITION

- The expulsion of urine from the urinary bladder is called **micturition**.
- Micturition is a reflex process but in adults, it can be controlled voluntarily to some extent.
- Urine formed by the nephrons is ultimately carried to the urinary bladder. Urinary bladder stores urine till a voluntary signal is given by the central nervous system (CNS). This signal is initiated by the stretching of the urinary bladder as it gets filled with urine. Then the stretch receptors on the walls of the bladder send signals to the CNS.
- The CNS passes on motor messages to initiate the contraction of smooth muscles of the bladder and simultaneously relaxes the urethral sphincter causing the release of urine. An adult human excretes, on an average, 1 to 1.5 litres of urine per day.

Urine

- Urine is a transparent, light yellow liquid with a slightly acidic pH (average pH 6.0).
- The colour of urine is caused by the pigment **urochrome**, which is a breakdown product of haemoglobin from worn out red blood corpuscles.
- On an average, 25-30 g of urea is excreted out per day.
- The pH range of urine is normally between 4.5 and 8.2 depending upon the amount of acidic and basic foods in the diet. A normal adult person secretes about 1.5 litres of urine in 24 hours.
- Glucose is normally absent in the urine. Presence of glucose (Gycosuria) and ketone bodies (Ketonuria) in urine are indicative of diabetes mellitus.

ROLE OF OTHER ORGANS IN EXCRETION

- Lungs, liver and skin also helps in the elimination of excretory wastes other than the kidneys.

Lungs

- Lungs remove large amounts of CO_2 and also significant quantities of water every day.

Liver

- Liver, the **largest gland** in our body, degrades haemoglobin of worn out red blood cells into bile-containing substances like bilirubin, biliverdin. Liver cells also excrete cholesterol, degraded steroid hormones, vitamins and drugs. Most of these substances ultimately pass out along with digestive wastes. Urea formed in liver is eliminated through kidneys.

Skin

- The **sudoriferous** and **sebaceous glands** in the skin can eliminate certain substances through their secretions.
- **Sweat** produced by the **sudoriferous glands** (sweat glands) is a watery fluid containing NaCl, small amounts of urea, lactic acid, etc., though the primary function of sweat is to facilitate a cooling effect on the body surface.
- **Sebaceous glands** eliminate certain substances like sterols, hydrocarbons and waxes through **sebum**. This secretion provides a protective oily covering for the skin.

ARTIFICIAL KIDNEY

- **Dialysis** is a procedure that is carried out by a machine called **artificial kidney** through which toxic substances are removed from the blood of person whose kidneys are completely damaged. It is of two types:
- **Peritoneal dialysis:** An implanted peritonal catheter is used to drain fluid into and from the peritoneal cavity by gravity (blood of peritoneal membrane is dialysed using dialysing fluid).
- **Haemodialysis:** When the kidneys are completely damaged and do not function, the patient often receives haemodialysis (treatment with an artificial kidney). Haemodialysis is the separation of unwanted substances from blood by use of a selectively permeable membrane.

DISORDERS OF EXCRETORY SYSTEM

Uremia

- Uremia is characterised by high concentration of non-protein nitrogens which include urea, uric acid, creatinine, etc. Excess of urea accumulated in blood is removed by haemodialysis.

Renal calculi

- Formation of stone or insoluble mass of crystallised salts (oxalates, etc.) in kidney. It gives rise to severe colic pain.

Renal failure

- Decrease or cessation of glomerular filtration, when both kidneys abruptly stop working. The urine production is affected. Glomerulonephritis inflammation of glomeruli of kidney.

Glomerulonephritis

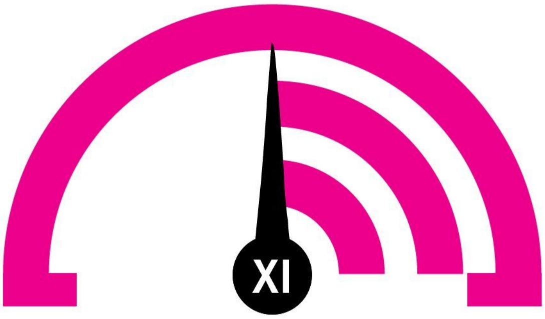
- Inflammation of glomeruli of kidney.

INTEXT PRACTICE QUESTIONS

10. What is the main function of counter current mechanism?

11. Define micturition.

MONTHLY TEST DRIVE



This specially designed column enables students to self analyse their extent of understanding of complete syllabus. Give yourself four marks for correct answer and deduct one mark for wrong answer. Self check table given at the end will help you to check your readiness.

Total Marks : 160

Complete Syllabus

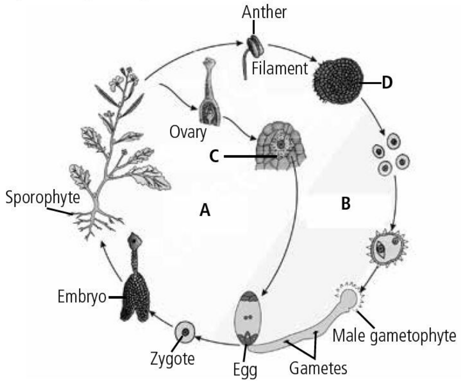
Time : 40 Min.

1. Select the correct sequence of taxonomic category of the given organism in ascending order.
- (a) *sapiens* → *Homo* → Hominidae → Primata → Mammalia → Chordata
- (b) *domestica* → *Musca* → Insecta → Diptera → Muscidae → Arthropoda
- (c) *aestivum* → Poaceae → Poales → *Triticum* → Monocotyledonae → Angiospermae
- (d) *indica* → Dicotyledonae → *Mangifera* → Anacardiaceae → Sapindales → Angiospermae

2. Which of the following hormone is synthesised by hypothalamus and is transported axonally to neurohypophysis?
- (a) GH
- (b) Oxytocin
- (c) Prolactin
- (d) Parathyroid hormone

3. Heterocysts are specialised cells in which
- (a) *Anabaena* can fix atmospheric carbon dioxide
- (b) *Nostoc* can fix atmospheric nitrogen
- (c) *Nostoc* can fix atmospheric oxygen
- (d) *Anabaena* can fix hydrogen sulfide.

4. Refer to the given figure and identify and select the correct option regarding the labelled parts.



- (a) A is showing haploid sporophytic generation of plants.
- (b) B is showing diploid gametophytic generation of plants.
- (c) C is a megasporangium in which megaspore mother cell undergo meiosis to form two diploid megaspores.
- (d) D is a microsporangium in which pollen mother cell meiotically produce microspores which matures into pollen grains.

5. Auxin was first isolated from
- (a) human urine
- (b) sperm DNA
- (c) wastes
- (d) ripened oranges.

6. The given table shows differences between chordates and non chordates.

	Chordates	Non-chordates
(i)	Notochord present.	Notochord absent.
(ii)	Gill slits are absent.	Pharynx perforated by gill slits.
(iii)	Heart is dorsal.	Heart is ventral.
(iv)	Post-anal tail is absent.	Post-anal tail is present.

Select the option with incorrect set of differences.
- (a) (i),(ii) and (iii)
- (b) (i),(iii) and (iv)
- (c) (ii),(iii) and (iv)
- (d) (i),(ii) and (iv)

7. Glycolysis is the breakdown of
- (a) pyruvic acid into glucose
- (b) glucose into pyruvic acid
- (c) glucose into malate
- (d) 3-PGA into glucose.

8. Actinomorphic flower is found in
- (a) mustard, *Datura* and chilli
- (b) pea, bean and *Cassia*
- (c) gulmohar, bean and *Cassia*
- (d) gulmohar, mustard and bean.

9. Read the given statements and select the correct option.

Statement I: The cells which cut off towards periphery, mature into secondary phloem.

Statement II: The cells which cut off towards pith, mature into secondary xylem.

(a) Both statements I and II are correct.
(b) Statement I is correct but statement II is incorrect.
(c) Statement I is incorrect but statement II is correct.
(d) Both statements I and II are incorrect.

10. Liver is the ________ gland of the body weighing about _________in an adult human.

(a) smallest, 1.2 to 1.5 kg
(b) largest, 1.2 to 1.5 kg
(c) largest, 2.1 to 2.3 kg
(d) smallest, 2.1 to 2.3 kg

11. Which of the following is/are correctly matched?

A. Inclusion bodies – stored reserve material in eukaryotic cells
B. Ribosome – Site of protein synthesis
C. Prokaryotic ribosome – 70S made up of two subunits 50S and 30S
D. Eukaryotic ribosome – 80S made up of two subunits 60S and 40S

(a) A and B only
(b) A, B and C only
(c) B, C and D only
(d) A and D only

12. Match the column I with column II and select the correct option.

	Column I		Column II
A.	Residual volume	(i)	500 mL
B.	Expiratory Reserve volume	(ii)	2500 to 3000 mL
C.	Tidal volume	(iii)	1000 to 1100 mL
D.	Inspiratory Reserve volume	(iv)	1100 to 1200 mL

	A	B	C	D
(a)	(iv)	(iii)	(i)	(ii)
(b)	(iv)	(iii)	(ii)	(i)
(c)	(iii)	(iv)	(i)	(ii)
(d)	(iv)	(i)	(iii)	(ii)

13. Match the following columns.

	Column I		Column II
A.	GLUT-4	(i)	Concanavalin A
B.	Antibody	(ii)	Morphine
C.	Collagen	(iii)	Enables glucose transport into cells
D.	Alkaloid	(iv)	Fight infectious agents
E.	Lectin	(v)	Intercellular ground substance

	A	B	C	D	E
(a)	(i)	(ii)	(v)	(iv)	(iii)
(b)	(iii)	(iv)	(v)	(ii)	(i)
(c)	(iv)	(iii)	(v)	(ii)	(i)
(d)	(iii)	(iv)	(ii)	(v)	(i)

14. What is the most abundant protein in the whole biosphere?

(a) Collagen
(b) RuBisCO
(c) Trypsin
(d) Insulin

15. Select the incorrectly matched pair.

(a) Gout-Inflammation of joints due to accumulation of uric acid crystals.
(b) Osteoporosis- Decreased levels of estrogen.
(c) Muscular dystrophy-Progressive degeneration of skeletal muscle due to genetic disorder.
(d) Tetany- Inflammation of joints.

Biobulletin

Voiceless frog discovered in Tanzania!!!

Nature is full of surprises, and a new species in Africa is certainly drawing attention — not for the sound it makes, but for the lack of any noise at all!

Lucinda Lawson, a conservation biologist and assistant professor of research at the University of Cincinnati with his colleagues have discovered a never-before-seen “voiceless” frog species in Tanzania’s Ukaguru mountains. The species belongs to a group of “spiny throated” reed frogs, which have tiny spines on the male’s throat.

The Ukaguru spiny-throated reed frog does not croak, sing, or ribbit at all. It’s one of the very few frog species that doesn’t vocally communicate with other frogs. According to the scientists, these species use the spine as something like Braille for species recognition.

The newly discovered reed frog belongs to the family of nearly 200 species in the Genus *Hyperolius*. This group of frogs has only a few species, found in small populations that make them rare and at risk of extinction.

A combination of genetic and genomic analyses confirmed the frog was distinct from other members of *Hyperolius*. Researchers also identified its closest evolutionary relation, *Hyperolius ruvuensis*, another species that is critically endangered and is likely to get extinct. Measurements found that the frog has unique body proportions, with smaller eyes in relation to its head than other spiny-throated reed frogs.

Finding a new member of this group is a major win for conservation.

16. Which of one the following statements is correct?
(a) Mitosis is called equational division because the number of chromosomes in parent and progeny cells are same.
(b) Cells in the quiescent stage remain metabolically inactive.
(c) The chromosomes are moved to spindle equator in anaphase.
(d) Chromatids move to opposite poles in metaphase.

17. The first step of urine formation is carried out by the
(a) glomerulus (b) DCT
(c) PCT (d) collecting duct.

18. Match the column I with column II.

Column I (Essential Nutrient Elements)	**Column II (Function)**
A. Iron	(i) Maintain anion -cation balance in cells
B. Magnesium	(ii) Formation of mitotic spindle
C. Calcium	(iii) Maintain the ribosome structure
D. Potassium	(iv) Formation of chlorophyll

	A	**B**	**C**	**D**
(a)	(iv)	(iii)	(ii)	(i)
(b)	(i)	(ii)	(iii)	(iv)
(c)	(ii)	(i)	(iii)	(iv)
(d)	(i)	(ii)	(iv)	(iii)

19. Read the given statements and select the correct option.

Statement I: Nitrification is carried by the bacteria *Pseudomonas* and *Thiobacillus*.

Statement II: Denitrification is carried by the bacterium *Nitrobacter*.

(a) Both statements I and II are correct.
(b) Statement I is correct but statement II is incorrect.
(c) Statement I is incorrect but statement II is correct.
(d) Both statements I and II are incorrect.

20. According to the Calvin cycle, how many CO_2, ATP and NADPH molecules are required to make one molecule of glucose?
(a) 12 CO_2, 10 ATP, 10 NADPH
(b) 6 CO_2, 18 ATP, 12 NADPH
(c) 5 CO_2, 19 ATP, 10 NADPH
(d) 10 CO_2, 12 ATP, 10 NADPH

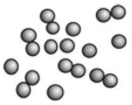
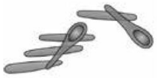
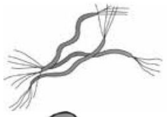
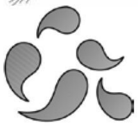
21. Read the given statements.
(i) Tap root system, as seen in mustard plant.
(ii) Fibrous root system, as seen in the wheat plant originate from base of the stem.
(iii) Adventitious root system as seen in the *Monstera* arise from the radicle.
(iv) Pneumatophore roots, as seen in *Rhizophora* that come out of the ground and grow vertically upwards.

Of the above statements, the correct ones are
(a) (i),(ii) and (iii) (b) (i),(ii) and (iv)
(c) (ii),(iii) and (iv) (d) (iii) and (iv).

22. What would be the respiratory quotient if 102 molecules of CO_2 release divided by consumption of 145 molecules of O_2?
(a) 0.9 (b) 1 (c) 0.3 (d) 0.7

23. Which of the following statements is incorrect?
(a) NAA and 2,4-D are synthetic auxins.
(b) IAA and IBA are natural auxins.
(c) ABA promotes seed germination.
(d) Ethylene is a simple gaseous PGR.

24. Match the column I with column II and select the correct option regarding the shape of bacteria.

Column I	**Column II**
A. Vibrio	(i) 
B. Spirilla	(ii) 
C. Bacilli	(iii) 
D. Cocci	(iv) 

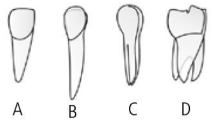
	A	**B**	**C**	**D**
(a)	(iv)	(iii)	(ii)	(i)
(b)	(iii)	(iv)	(ii)	(i)
(c)	(iv)	(iii)	(i)	(ii)
(d)	(ii)	(iii)	(iv)	(i)

25. What is the function of typhlosole in the alimentary canal of earthworm?
(a) It helps in grinding soil particles.
(b) It neutralises the humic acid.
(c) It increases the area of absorption.
(d) All of these

26. Which one of the following is incorrect match of digestive system disorder with their symptoms?

(a) Jaundice- Lung is affected, skin turns yellow due to the deposition of bile pigments.
(b) Diarrhoea- Abnormal frequency of bowel movement and increased liquidity of the faecal discharge.
(c) Constipation- Irregular bowel movements.
(d) Indigestion- Improper food digestion.

27. Identify A, B, C and D.



	A	B	C	D
(a)	Molar	Premolar	Canine	Incisor
(b)	Incisor	Canine	Premolar	Molar
(c)	Canine	Premolar	Molar	Incisor
(d)	Premolar	Canine	Incisor	Molar

28. Fill in the blanks with an appropriate option.
(i) The endoplasmic reticulum bearing ribosomes on their surface is called _____.
(ii) RER is involved in synthesis and secretion of _____.
(iii) SER is the major site for synthesis of _____.

	(i)	(ii)	(iii)
(a)	RER	protein	lipid
(b)	SER	protein	lipid
(c)	RER	lipid	protein
(d)	SER	lipid	protein

29. Which among the following is not a conducting part of respiratory system?
(a) Trachea
(b) Pharynx
(c) Alveoli
(d) Bronchi

30. Read the given statements and identify them as true (T) or false (F).
(i) Leucocytes are colourless due to lack of hemoglobin.
(ii) Leucocytes are generally long lived.
(iii) Erythrocytes are the most abundant of all the cells in blood.
(iv) RBCs have an average life span of 150 days.

	(i)	(ii)	(iii)	(iv)
(a)	T	T	F	F
(b)	T	F	T	F
(c)	T	F	F	F
(d)	F	T	T	T

31. Platelets are also called______which normally contains ________ platelets mm^{-3}.
(a) thrombocytes; 1,500,00-3,500,00
(b) erythrocytes; 1,500,00-3,500,00

PUBLIC NOTICE

CUET 2023

National Testing Agency has been mandated by the **Ministry of Education and UGC** to conduct Common University Entrance Test (CUET) for admission into **Undergraduate Programmes** in **Central Universities under Ministry of Education, and other participating Universities / Institutions / Organizations / Autonomous Colleges**.

CUET (UG) will provide a **single window opportunity to students seeking admission in any of the Central Universities (CUs) or other participating organizations (including State Universities, Deemed and Private Universities) across the Country**.

For the Academic Session **2023-24, CUET (UG) – 2023** will be conducted in the **Computer Based Test (CBT) mode** as per the details given below :

Online Submission of Application Form	**09 February to 12 March 2023 (Up to 09:00 P.M.)**
Last date of successful transaction of fee through Credit / Debit Card / Net-Banking / UPI	**12 March 2023 (up to 11:50 P.M.)**
Correction in Particulars	**15 March to 18 March 2023 (Up to 11:50 P.M.)**
Announcement of the City of Examination	**30 April 2023**
Downloading of Admit Cards from the NTA website	**Second week of the May 2023**
Date of Examination	**21 May 2023 onwards**
Display of Recorded Responses and Answer Keys	To be announced later on the website
Website(s)	www.nta.ac.in, https://cuet.samarth.ac.in/
Declaration of Result on the NTA website	*To be announced later on the website*

The details of the programmes offered by Central Universities (CUs) and other participating Universities / Organizations are available on their respective websites as well as on https://cuet.samarth.ac.in/ **Candidates must carefully refer to the eligibility requirements of the programmes offered by various Central Universities and participating Universities / Organizations in this regard**.

The CUET (UG) - 2023 will be conducted in **13 languages** i.e. **English, Hindi, Assamese, Bengali, Gujarati, Kannada, Malayalam, Marathi, Odia, Punjabi, Tamil, Telugu, and Urdu**.

For CUET (UG) - 2023, the following is the scheme of examination :

Section	Subjects/ Tests	Questions to be Attempted
Section 1A - Languages	There are 13 different languages. Any of these languages may be chosen.	40 questions to be attempted out of 50 in each language
Section 1B - Languages	There are 20 Languages. Any of these languages may be chosen.	
Section 2 - Domain Specific Subject	There are 27 Domain specific subjects being offered under this section. A candidate may choose any subject as desired by the applicable University/ Organization.	35/40 Questions to be attempted out of 45/50
Section 3 - General Test	For any such undergraduate programme / programmes being offered by Universities where a General Test is being used for admission.	50 Questions to be attempted out of 60

Note:
1. *From the above subjects / languages, the* ***candidate can choose maximum of 10 subjects from all three Section.***
2. ***Examination will be conducted on multiple days in three shifts, depending on the number of Candidates and Subject choices.***

In case any candidate faces difficulty in applying for **CUET (UG) – 2023**, he/she may contact **011 - 40759000 / 011 - 69227700** or e-mail at **cuet-ug@nta.ac.in**. The candidates are also advised to be in touch with the NTA website(s) www.nta.ac.in and https://cuet.samarth.ac.in/ for the latest updates regarding the exam.

(c) leucocytes; 1,500,00-3,500,00
(d) leucocytes; 20,000-30,000

32. Which one of the following waves represent the return of the ventricles from excited to normal state?
(a) P-wave (b) Q-wave
(c) T-wave (d) S-wave

33. Hydroponics technique is growing plants in
(a) soil (b) nutrient solution
(c) polluted area (d) pollution free area.

34. An increase in blood flow to the atria of heart can cause the release of
(a) renin (b) vasopressin
(c) aldosterone (d) atrial natriuretic factor

35. Consider the following statements and identify them as true (T) or false (F).
(i) Mammals, many terrestrial amphibians and marine fishes mainly excrete urea.
(ii) Many bony fishes, aquatic amphibians and aquatic insects excrete arginine.
(iii) Reptiles, birds, land snails and insects excrete uric acid.

	(i)	**(ii)**	**(iii)**
(a)	F	F	T
(b)	T	T	F
(c)	T	F	T
(d)	T	T	F

36. _________is a flat bone on the ventral midline of thorax.
(a) Pectoral girdle (b) Acetabulum
(c) Sternum (d) Clavicle

37. Select the correct sequence of catalytic cycle of an enzyme action.
(i) The substrate binds to the active site of the enzyme.
(ii) The binding of the substrate induces the enzyme to alter its shape.
(iii) The enzyme releases the products of the reaction and the free enzyme is ready to bind another substrate.
(iv) The active site of the enzyme is in close proximity with the substrate.
(a) (i) → (ii) → (iv) → (iii)
(b) (i) → (ii) → (iii) → (iv)
(c) (iv) → (iii) → (ii) → (i)
(d) (ii) → (iii) → (iv) → (i)

38. Read the given statements and select the correct option.

Statement I: The nose contains mucus-coated receptors specialised for receiving the sense of smell which are called olfactory receptors.

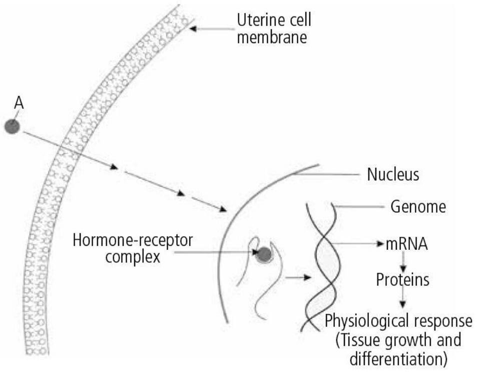
Statements II: Olfactory bulbs are extensions of brain's limbic system.

(a) Both statements I and II are correct.
(b) Statement I is correct but statement II is incorrect.
(c) Statement I is incorrect but statement II is correct.
(d) Both statements I and II are incorrect.

39. Which one of the following options gives the incorrect matching of class of fungi with its examples?

	Classes of fungi	**Examples**
(a)	Basidiomycetes	– *Ustilago* and *Puccinia*
(b)	Phycomycetes	– *Rhizopus* and *Albugo*
(c)	Ascomycetes	– *Penicillium* and *Saccharomyces*
(d)	Deuteromycetes	– *Claviceps* and *Neurospora*

40. Which of the following hormones is responsible for the mechanism of hormone action shown below?



(a) Insulin (b) FSH
(c) Parathyroid hormone (d) Estrogen ☺☺

Key is published in this issue. Search now! ☺

SELF CHECK

No. of questions attempted ......
No. of questions correct ......
Marks scored in percentage ......

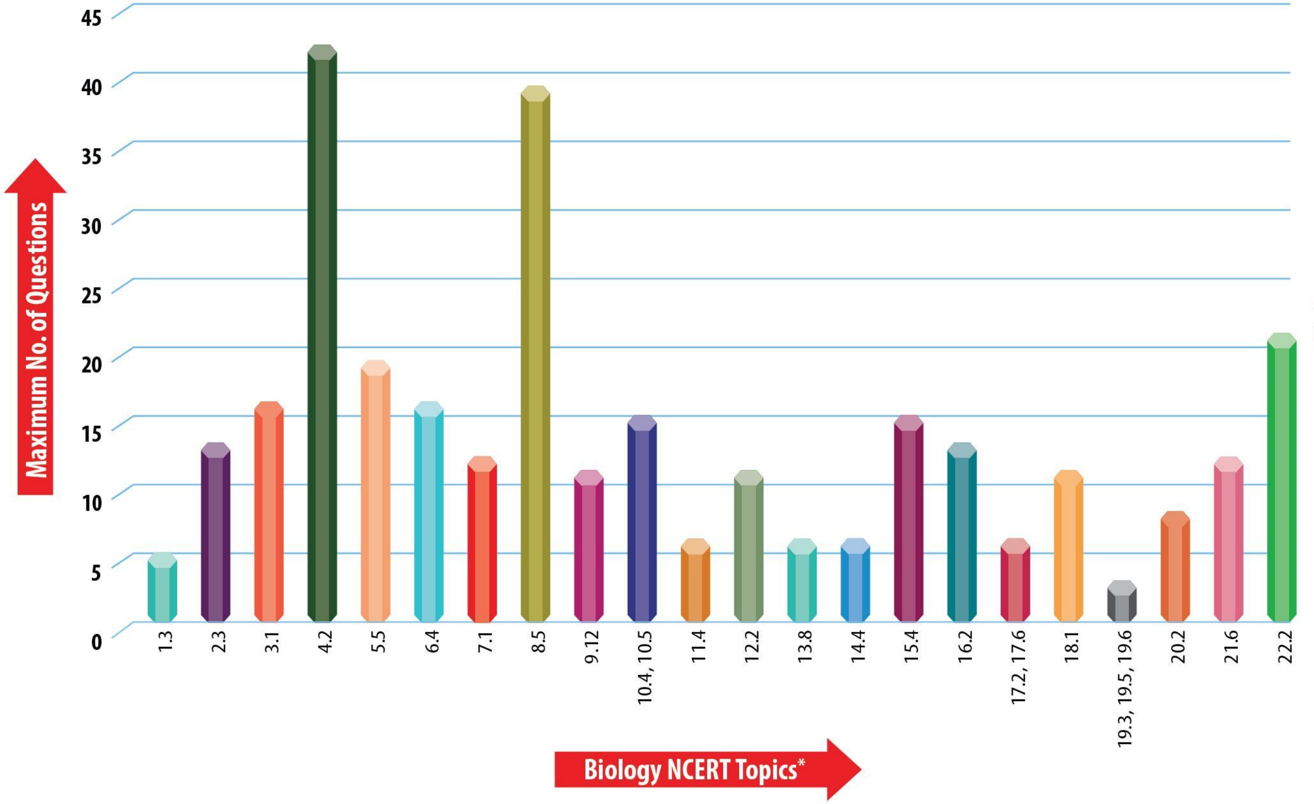
Check your score! If your score is

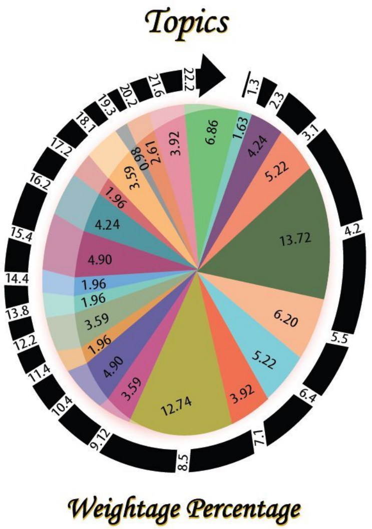
> 90%	**EXCELLENT WORK !**	You are well prepared to take the challenge of final exam.
90-75%	**GOOD WORK !**	You can score good in the final exam.
74-60%	**SATISFACTORY !**	You need to score more next time.
< 60%	**NOT SATISFACTORY!**	Revise thoroughly and strengthen your concepts.

Are You Ready for NEET?

Past 10 Years (2013-2022) Chapterwise and Topicwise Trend Analysis of NEET Questions

CLASS 11





*These are the topics from where maximum number of questions have been asked in the past 10 years.

Some of the important topics extracted from the graphical analysis are explained here with HD images.*

01 | The Living World

Taxonomic Categories in Ascending Order

Species → Genus → Family → Order → Class → Phylum or Division → Kingdom

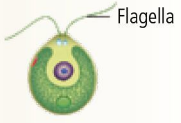
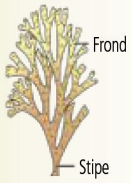
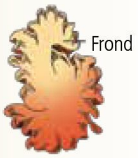
02 | Biological Classification

Classification of Fungi

Phycomycetes	Ascomycetes	Basidiomycetes	Deuteromycetes
Algal fungi	Sac fungi	Club fungi	Fungi imperfecti
Aseptate, coenocytic	Septate, branched	Septate, branched	Septate, branched
Zoospores, aplanospores,	Conidiophores	Basidiospores	Conidia
Isogamy, oogamy, anisogamy	Ascospores (endogenously)	Basidiospores (exogenously)	Absent or not known
Zygosporangium	Ascocarp	Basidiocarp	Absent
Mucor, *Rhizopus*, *Albugo*	*Penicillium*, *Saccharomyces*	*Agaricus*, *Ustilago*, *Puccinia*	*Trichoderma*

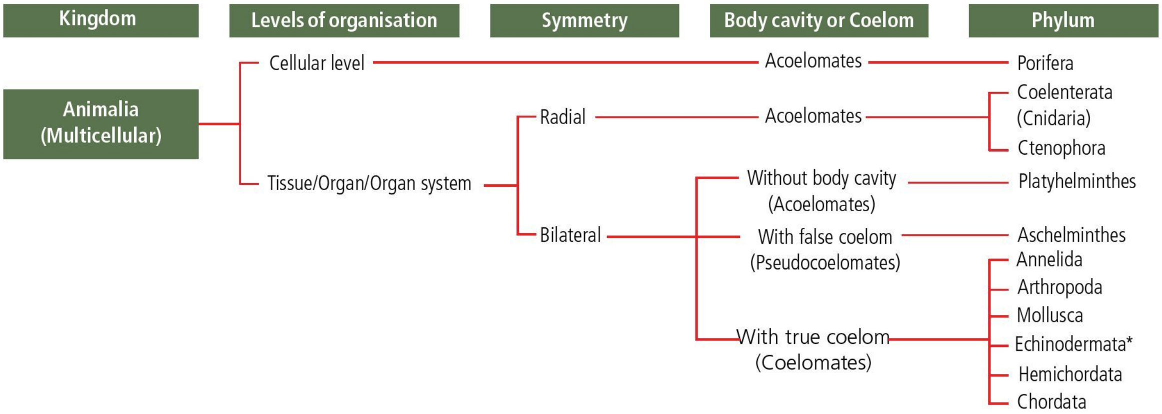
03 | Plant Kingdom

Classification of Algae

Classes	Structure	Major pigments	Store food	Examples
Chlorophyceae (Green algae)	Unicellular, colonial, coenobial, filamentous, cell wall cellulosic, motile cells with 2-8 equal flagella.	Chl *a* and *b*	Starch	 *Chlamydomonas*
Phaeophyceae (Brown algae)	Branched, filamentous, cell wall composed of cellulose and algin, motile cells with 2 unequal lateral flagella.	Chl *a* and *c*, fucoxanthin	Laminarin, mannitol	 *Fucus*
Rhodophyceae (Red algae)	Unicellular, filamentous, cell wall cellulosic and pectic, motile cells not known.	Chl *a* and *d*, phycoerythrins	Floridean starch	 *Porphyra*

04 | Animal Kingdom

Classification of Animal Kingdom

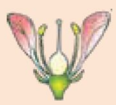

Kingdom
Levels of organisation
Symmetry
Body cavity or Coelom
Phylum
Animalia (Multicellular)
Cellular level
Acoelomates
Porifera
Radial
Acoelomates
Coelenterata (Cnidaria)
Ctenophora
Tissue/Organ/Organ system
Without body cavity (Acoelomates)
Platyhelminthes
Bilateral
With false coelom (Pseudocoelomates)
Aschelminthes
With true coelom (Coelomates)
Annelida
Arthropoda
Mollusca
Echinodermata*
Hemichordata
Chordata

*Echinodermata exhibits radial or bilateral symmetry depending on the stage

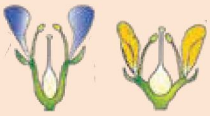
05 | Morphology of Flowering Plants

The Flower

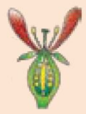
Position of floral parts on thalamus



Hypogynous (Superior)
E.g., Mustard, China rose, Brinjal

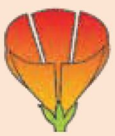


Perigynous (Half inferior)
E.g., Plum, Rose, Peach

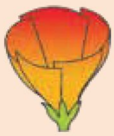


Epigynous (Inferior)
E.g., Guava, Cucumber

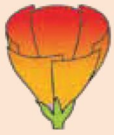
Aestivation in corolla



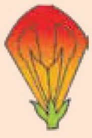
Valvate
E.g., *Calotropis*



Twisted
E.g., China rose



Imbricate
E.g., *Cassia*



Vexillary
E.g., Pea, Bean

Types of Placentation

Marginal (*e.g.*, Pea); **Axile** (*e.g.*, China rose, tomato); **Parietal** (*e.g.*, Mustard, *Argemone*); **Free central** (*e.g.*, *Dianthus*, Primrose); **Basal** (*e.g.*, Sunflower, marigold)

06 | Anatomy of Flowering Plants

Secondary Growth

- **Spring wood/Early wood :** Wood formed during spring season, more active cambium, many xylary elements, wide vessels.
- **Autumn wood/Late wood :** Wood formed during winter, cambium less active, few xylary elements and narrow vessels.
- **Heartwood :** Central wood of an old stem, dead elements, highly lignified walls, living cells absent and provide mechanical support to stem.
- **Sapwood :** Outer wood of an old stem, light coloured, living cells present and provides conduction of water and minerals from root to leaf.

Recap

- Cork cambium = phellogen
- Cork = phellem
- Secondary cortex = phelloderm
- Phellogen + phellem + phelloderm = periderm

07 | Structural Organisation in Animals

Animal Tissues

Epithelial Tissue (Secretion and absorption)

- Squamous → Air sacs of lungs, walls of blood vessels
- Columnar → Lining of stomach and intestine
- Cuboidal → Tubular parts of nephron
- Ciliated → Bronchioles, fallopian tube

Connective Tissue (Link and support other tissues)

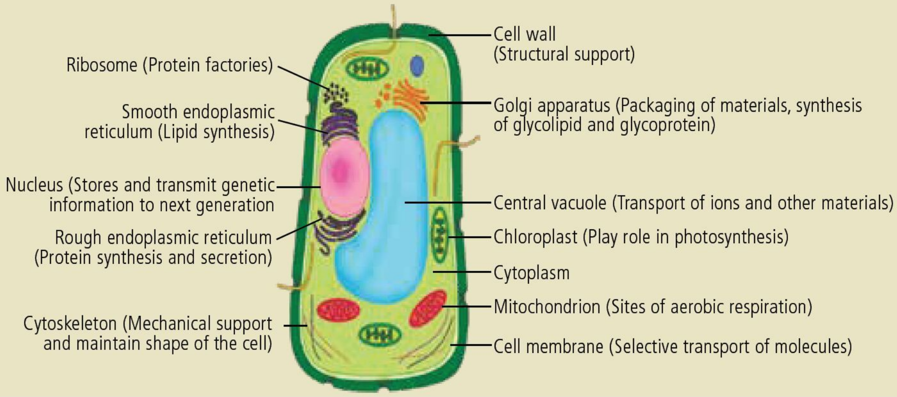
- Loose connective tissue (Beneath the skin) : (a) Areolar and (b) Adipose
- Dense irregular connective tissue : (a) Tendons (attach skeletal muscle to bone) and (b) Ligaments (attach bone to bone)

Muscle Tissue (Movement of body)

- Skeletal tissues (biceps)
- Smooth muscles (walls of internal organs)
- Cardiac muscles (heart)

08 | Cell : The Unit of Life

Eukaryotic Cell


Ribosome (Protein factories)
Smooth endoplasmic reticulum (Lipid synthesis)
Nucleus (Stores and transmit genetic information to next generation
Rough endoplasmic reticulum (Protein synthesis and secretion)
Cytoskeleton (Mechanical support and maintain shape of the cell)
Cell wall (Structural support)
Golgi apparatus (Packaging of materials, synthesis of glycolipid and glycoprotein)
Central vacuole (Transport of ions and other materials)
Chloroplast (Play role in photosynthesis)
Cytoplasm
Mitochondrion (Sites of aerobic respiration)
Cell membrane (Selective transport of molecules)

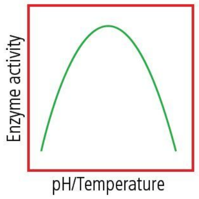
09 | Biomolecules

Enzymes

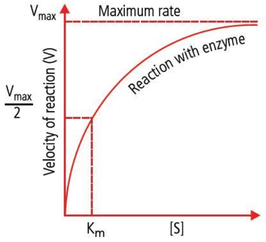
- Enzymes are organic catalysts which catalyse biochemical reactions without being utilising themselves.

$$E + S \rightleftharpoons ES \longrightarrow EP \longrightarrow E + P$$

Effect of change in pH/Temperature



Effect of change in concentration of substrate on enzyme activity



10 | Cell Cycle and Cell Division

Meiosis

- Meiosis involves two sequential cycles of nuclear and cell division called **Meiosis I (Reductional division)** and **Meiosis II (Equational division)**.

Meiosis I : Stages of Prophase-I

1. **Leptotene :** Compaction of chromosomes
2. **Zygotene :** Pairing of homologous chromosomes (synapsis)
3. **Pachytene :** Crossing over occurs
4. **Diplotene :** Dissolution of synaptonemal complex
5. **Diakinesis :** Terminalisation of chiasmata

Memorise

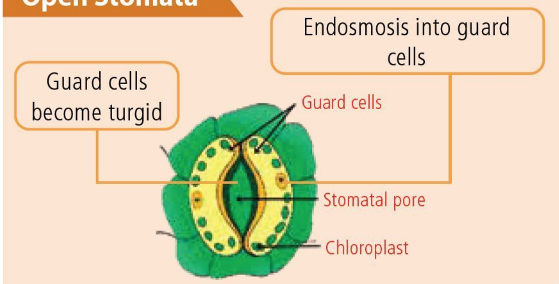
- Anaphase I - Homologous chromosomes separate.
- Anaphase II - Splitting of centromere.

11 | Transport in Plants

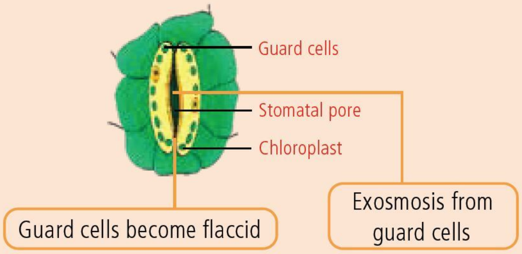
Transpiration

Evaporative loss of water through stomata present in leaves.

Open Stomata


Endosmosis into guard cells
Guard cells become turgid
Guard cells
Stomatal pore
Chloroplast

Closed Stomata


Guard cells
Stomatal pore
Chloroplast
Guard cells become flaccid
Exosmosis from guard cells

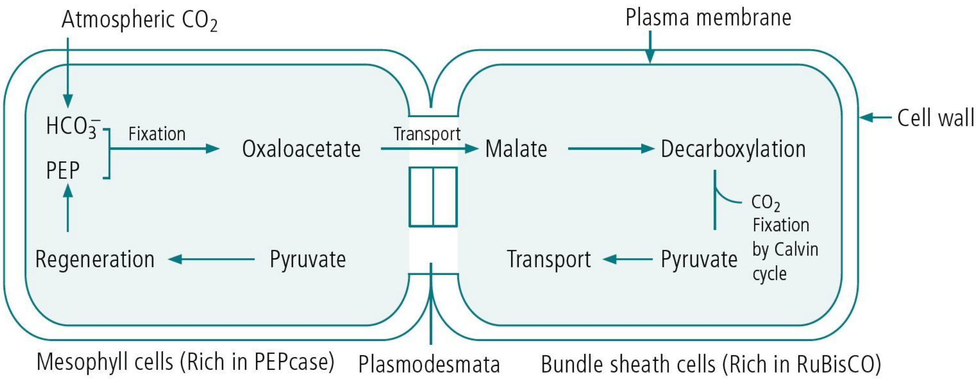
12 | Mineral Nutrition

Essential Mineral Elements

Elements	Functions
Macronutrients	
1. Potassium (K^+)	Anion-cation balance, opening and closing of stomata.
2. Calcium (Ca^{2+})	Synthesis of calcium pectate, formation of mitotic spindle.
3. Magnesium (Mg^{2+})	Activates RuBisCO and PEPcase, constituent of ring structure of chlorophyll, maintain ribosome structure.
Micronutrients	
4. Iron (Fe^{3+}), copper (Cu^{2+})	Redox reactions.
5. Manganese (Mn^{2+}), Chlorine (Cl^-)	Splitting of water during photosynthesis.
6. Zinc (Zn^{2+})	Activates carboxylase and alcohol dehydrogenase, synthesis of auxin.
7. Boron (BO_3^{3-} or $B_4O_7^{2-}$)	Pollen germination, carbohydrate translocation.

13 | Photosynthesis in Higher Plants

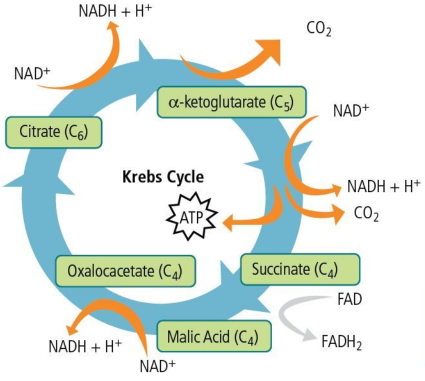
C_4 Pathway (Hatch and Slack Pathway)


Atmospheric CO_2
Plasma membrane
HCO_3^-
PEP
Fixation
Oxaloacetate
Transport
Malate
Decarboxylation
Cell wall
CO_2 Fixation by Calvin cycle
Regeneration
Pyruvate
Transport
Pyruvate
Mesophyll cells (Rich in PEPcase)
Plasmodesmata
Bundle sheath cells (Rich in RuBisCO)

14 | Respiration in Plants

Aerobic Respiration

TCA Cycle (Mitochondrial matrix)


NADH + H^+
CO_2
NAD^+
Citrate (C_6)
α-ketoglutarate (C_5)
NAD^+
Krebs Cycle
ATP
NADH + H^+
CO_2
Oxalocacetate (C_4)
Succinate (C_4)
FAD
Malic Acid (C_4)
$FADH_2$
NADH + H^+
NAD^+

Stage	ATP by substrate phosphorylation	Formation of NADH/$FADH_2$	ATP through ETS in mitochondria
Glycolysis in cytoplasm	2	2 NADH	2 × 3 = 6 ATP
Formation of acetyl CoA in matrix of mitochondria	–	2 NADH	2 × 3 = 6 ATP
Krebs' cycle	2	2 $FADH_2$ 6 NADH	2 × 2 = 4 ATP 6 × 3 = 18 ATP
	4		34 (or 32) ATP

- Oxidation of 1 molecule of NADH gives 3 ATP while that of 1 molecule of $FADH_2$ produces 2TP.
- Total net gain of ATP = 36 or 38 depending upon type of aerobic respiration

15 | Plant Growth and Development

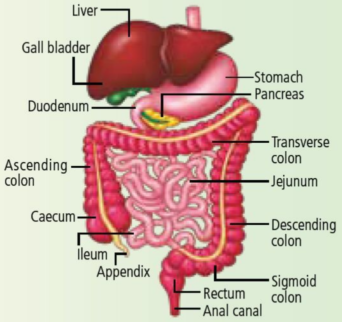
Plant Growth Regulators

- Plant growth promoters
  - **Auxin**
    - Prevent fruit and leaf drop at early stages
    - Promote apical dominance
    - Induce parthenocarpy
  - **Gibberellin**
    - Increase in length of axis
    - Promotes bolting
    - Delay senescence
  - **Cytokinin**
    - Promote cell division
    - Inhibit apical dominance
    - Delay leaf senescence
- Plant growth inhibitors
  - **Ethylene**
    - Breaks seed dormancy
    - Initiate flowering
    - Hastens fruit ripening
  - **Abscisic acid**
    - Inhibits seed germination
    - Stimulates closure of stomata
    - Stress hormone

16 | Digestion and Absorption

Digestion of Nutrients in Different Parts of Body

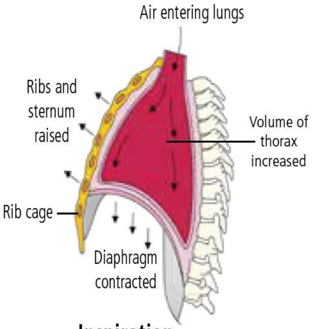
- **Oral cavity** (Starch ⟶ Maltose)
- **Stomach** (Proteins ⟶ Proteoses + Peptones)
- **Pancreas** (Starch ⟶ Disaccharides, Proteins/peptones/proteoses ⟶ Dipeptides; Nucleic acids ⟶ Nucleosides)
- **Small intestine**
  - Dipeptides ⟶ Amino acids
  - Disaccharides ⟶ Monosaccharides
  - Nucleotides ⟶ Nucleosides ⟶ Sugar + Bases
  - Di and Monoglycerides ⟶ Fatty acids + Glycerol


Liver
Gall bladder
Duodenum
Stomach
Pancreas
Transverse colon
Ascending colon
Jejunum
Caecum
Descending colon
Ileum
Appendix
Sigmoid colon
Rectum
Anal canal

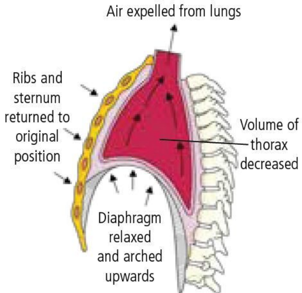
The Human Digestive System

17 | Breathing and Exchange of Gases

Mechanism of Breathing


Air entering lungs
Ribs and sternum raised
Volume of thorax increased
Rib cage
Diaphragm contracted

Inspiration


Air expelled from lungs
Ribs and sternum returned to original position
Volume of thorax decreased
Diaphragm relaxed and arched upwards

Expiration

Respiratory volumes and capacities

- Tidal volume ⇒ 500 mL
- IRV ⇒ 2500 – 3000 mL
- ERV ⇒ 1000 – 1100 mL
- RV ⇒ 1100 – 1200 mL
- IC = TV + IRV
- EC = TV + ERV
- FRC = ERV + RV
- VC = ERV + TV + IRV
- TLC = RV + ERV + TV + IRV or VC + RV

18 | Body Fluids and Circulation

Blood

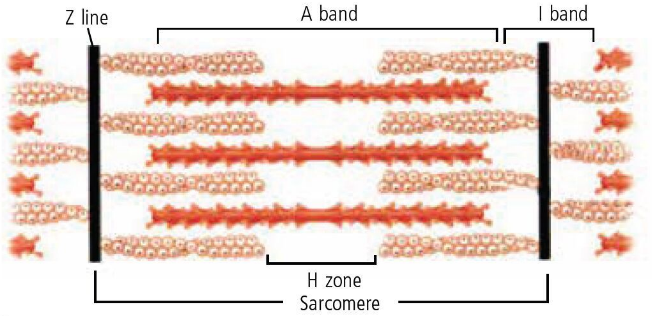
Blood Corpuscles

Blood corpuscles or formed elements are of three types: erythrocytes, leucocytes and thrombocytes.

- **Erythrocytes** or red blood cells are most abundant cells in human body and help in oxygen transport.
- **Thrombocytes** or blood platelets are involved in blood clotting.
- **Leucocytes** or white blood cells are involved in defence mechanism of body.
  - Granulocytes
    - Neutrophils (60-65%)
    - Basophils (0.5-1%)
    - Eosinophils (2-3%)
  - Agranulocytes
    - Lymphocytes (20–25%)
    - Monocytes (6-8%)

20 | Locomotion and Movement

Structure of Muscle Fibre

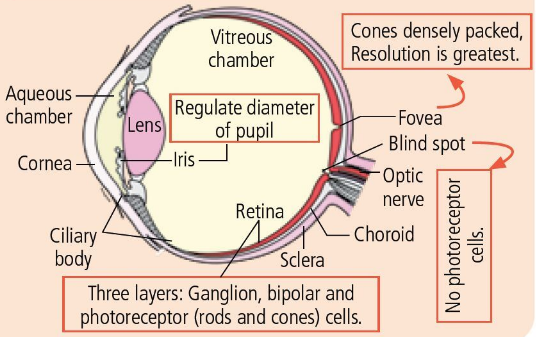

Z line
A band
I band
H zone
Sarcomere

Mechanism of **muscle contraction** is best explained by **sliding filament** theory which states that contraction of a muscle fibre takes place by the sliding of the thin (actin) filaments over the thick (myosin) filaments.

21 | Neural Control and Coordination

Sensory Organs

Eye


Vitreous chamber
Aqueous chamber
Lens
Cornea
Iris
Ciliary body
Retina
Sclera
Choroid
Optic nerve
Blind spot
Fovea

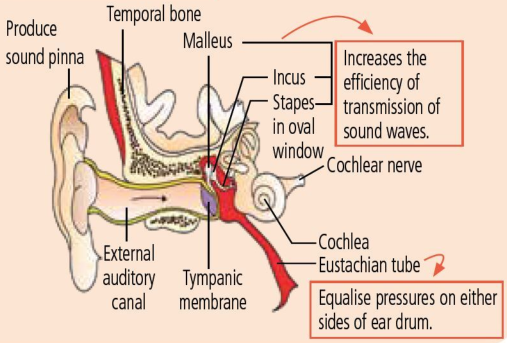
Cones densely packed, Resolution is greatest.

Regulate diameter of pupil

No photoreceptor cells.

Three layers: Ganglion, bipolar and photoreceptor (rods and cones) cells.

Ear


Produce sound pinna
Temporal bone
Malleus
Incus
Stapes in oval window
Cochlear nerve
Cochlea
Eustachian tube
External auditory canal
Tympanic membrane

Increases the efficiency of transmission of sound waves.

Equalise pressures on either sides of ear drum.

22 | Chemical Coordination and Integration

Human Endocrine System

Secreted by	Hormones	Disorders
Pituitary gland	- Growth hormone (GH)	Hypersecretion : Gigantism and acromegaly (Adults) Hyposecretion : Dwarfism
Thyroid gland	- Thyroxine (T_4) and tri-iodothyronine (T_3)	Hyposecretion : Cretinism (Children), myxoedema (Adults) Hypersecretion : Graves' disease, exophthalmic goitre
Pancreas	- Insulin (from β cells) - Glucagon (from α cells)	Hypersecretion : Diabetes mellitus in which sugar level in blood increases Hyposecretion : Hypoglycemia
Adrenal gland	- Adrenaline (epinephrine) - Nor-adrenaline (Norepinephrine)	Hyposecretion : Low blood pressure and slow working of heart and lungs Hypersecretion : Rise in blood pressure, rapid heart beats and breathing
	- Adrenocorticoids (Cortisol, Aldosterone)	Hyposecretion : Addison's disease Hypersecretion : Cushing's syndrome, aldosteronism, adrenal virilism and gynaecomastia

Check Your Vitals for NEET

Maximise your chance of success in medical entrance exams by reading this article. This section is specially designed to optimise your preparation by practising more and more. It is a unitwise series having chapterwise question bank, allowing you to prepare systematically and become more competent.

- ☝ Recall question or single concept question – indicated by a single finger.
- ✌ Application question or question which requires 2 or 3 concepts - indicated by 2 fingers.
- 🤟 Application question or question which requires 3 or more concepts - indicated by 3 fingers.

UNIT-V : HUMAN PHYSIOLOGY (PART-II)

CHAPTER-18 : BODY FLUIDS AND CIRCULATION

Multiple Choice Questions

✌**1.** During an examination, the cardiologist noticed that the P-R interval in a patient's electrocardiogram was 0.4 seconds long. This probably indicated that
(a) the patient had clot in the coronary artery
(b) the patient was suffering from atherosclerotic heart disease or rheumatic fever
(c) the tricuspid valve had displaced downward into right ventricle
(d) the patient was highly prone to myocardial infarction.

☝**2.** An oval depression present in the right atrium adjoining the interatrial septum is called
(a) fossa ovalis (b) crista terminalis
(c) foramen ovale (d) cisterna chyli.

☝**3.** Individuals that have blood group AB have
(a) both antigens A and B on their RBCs
(b) both antibodies A and B in their plasma
(c) no antibodies A and B in their plasma
(d) both (a) and (c).

✌**4.** Arrange the given steps of blood coagulation in a sequence and select the correct option.
(i) Depolymerisation of fibrinogen by thrombin into monomers
(ii) Formation of enzyme prothrombinase
(iii) Inactivation of heparin
(iv) Breakdown of prothrombin into thrombin
(v) Repolymerisation of monomers into fibrin
(vi) Release of platelet factor-3 and thromboplastin
(vii) Formation of clot
(a) (vi) → (iv) → (ii) → (iii) → (i) → (v) → (vii)
(b) (ii) → (vi) → (iii) → (iv) → (i) → (v) → (vii)
(c) (vi) → (ii) → (iii) → (iv) → (i) → (v) → (vii)
(d) (iii) → (ii) → (vi) → (iv) → (i) → (v) → (vii)

☝**5.** The second heart sound is heard when
(a) the bicuspid and tricuspid valves close
(b) the blood flows from atria to the ventricles
(c) the semilunar valves close
(d) the blood flows into vena cava.

☝**6.** Which of the following statements is incorrect about arteries?
(a) Walls of arteries are thick and muscular.
(b) Arteries have valve which prevents backward flow of blood.
(c) Outermost coat, tunica adventitia is formed of connective tissues.
(d) All arteries carry oxygenated blood except pulmonary artery.

☝**7.** The arteries that carry nutrients to the lungs are called __(i)__ and belong to __(ii)__ circulation.

	(i)	(ii)
(a)	bronchial arteries	systemic
(b)	pulmonary arteries	pulmonary
(c)	coronary arteries	coronary
(d)	brachial arteries	systemic

☝**8.** The condition that leads to uncoordinated rapid contraction of heart muscles is called
(a) Stokes-Adams syndrome
(b) Ebstein's disease
(c) fibrillation
(d) ischaemia.

9. Select the mismatched pair.
(a) AV node - Pace setter
(b) Malpighian bodies - Red pulp of spleen
(c) Erythroblastosis fetalis - Rh incompatibility
(d) Thebasian valve - Opening of coronary sinus

10. The structures present in heart that hold the atrioventricular valves in place while the heart is pumping blood are called
(a) papillary muscles (b) chordae tendineae
(c) columnae carneae (d) trabeculae carneae.

11. pH of human blood is
(a) 6.5 (b) 7.4 (c) 5.8 (d) 8.2.

12. In a cardiac cycle, if the stroke volume is 70 mL and heart rate is 72 beats/minute, then cardiac output is
(a) 142 mL/minute (b) 72 mL/minute
(c) 1070 mL/minute (d) 5040 mL/minute.

13. A person may suffer from splenomegaly due to
(a) increased destruction of RBCs
(b) leukemia
(c) increased phagocytosis by macrophages
(d) all of these.

14. The procedure done to remove atherosclerotic plaques from coronary artery in case of partial blockage is called
(a) angioplasty
(b) coronary artery bypass grafting
(c) defibrillation
(d) cardioversion.

15. The eustachian valve guards the opening of
(a) superior vena cava
(b) pulmonary trunk and aorta
(c) inferior vena cava
(d) coronary sinus.

Match The Columns

16. Match the column I with column II.

	Column I		Column II
A.	P wave	(i)	Ventricular depolarisation
B.	Q-T interval	(ii)	Less than 0.2 sec
C.	QRS wave	(iii)	Atrial depolarisation
D.	P-R interval	(iv)	Less than 0.42 sec
E.	T wave	(v)	Ventricular repolarisation

17. Match the column I with column II. (There can be more than one match for items in column I.)

	Column I		Column II
A.	Lymphocytes	(i)	Amoeboid shape
B.	Basophils	(ii)	Three-lobed nucleus
C.	Thrombocytes	(iii)	Barr body in female mammals
D.	Neutrophils	(iv)	Antibody production
E.	Monocytes	(v)	60-65% of WBCs
		(vi)	Non nucleated cell fragments
		(vii)	Blood clotting
		(viii)	Large rounded nucleus
		(ix)	Bean shaped nucleus
		(x)	Release heparin and histamine

Passage Based Questions

18.(A) Complete the given passage with appropriate words.
The (i) cycle is the single cycle of contraction and relaxation of cardiac muscles. It starts with the (ii) systole that occurs due to the wave of contraction stimulated by (iii) node. The blood flows into the ventricles due to the opening of (iv) and (v) valves. The AV node stimulates the ventricles to contract which leads to (vi) systole. The (iv) and (v) valves close causing the blood to flow into (vii) trunk and aorta as (viii) valves open. The (viii) valves close and (ix) diastole begins. The pressure in the (x) falls resulting in the flow of blood from atrium.

(B) Read the given passage and correct the errors, wherever present.
The hepatic portal circulation is the flow of oxygenated blood from the digestive organs to the lungs before it reaches the heart. The hepatic vein supplies oxygenated blood from abdominal aorta and hepatic artery carries deoxygenated blood from digestive organs. Gastric vein opens directly into hepatic portal vein and drains blood from the gall bladder. All these veins open into hypophysial portal vein that open into superior vena cava. Through this portal system, the liver provides glucose to the body in case of low blood glucose level and converts urea into ammonia to detoxify the blood.

Assertion & Reason

In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :
(a) If both A and R are true and R is the correct explanation of A.
(b) If both A and R are true but R is not the correct explanation of A.
(c) If A is true but R is false. (d) If A is false but R is true.

19. **Assertion :** Thyroxine hormone secreted by the thyroid gland increases heart beat.
Reason : Thyroxine increases the oxidative metabolism of body cells which increases the oxygen demand.

20. **Assertion :** Deficiency of vitamin K can lead to impaired blood clotting at the site of injury.
Reason : Vitamin K is required for the synthesis of prothrombin in the liver.

21. **Assertion :** Mature mammalian erythrocytes are enucleated and lack cell organelles such as Golgi bodies, mitochondria, etc.

Reason : Mature mammalian erythrocytes depend on anaerobic respiration for their energy requirement.

22. **Assertion :** Atherosclerosis is the stiffness and loss of elasticity of arteries.

Reason : Arteriosclerosis hardens the arteries due to calcification and cholesterol deposition.

23. **Assertion :** First blood transfusion of Rh^+ blood to Rh^- person causes no harm.

Reason : In the first blood transfusion, the Rh^- person develops Rh antibodies in his blood.

24. **Assertion :** Injury to semilunar valves causes soft hissing noise, called heart murmur.

Reason : Semilunar valves are injured due to syphilis or rheumatic fever.

25. **Assertion :** People with prosthetic cardiac pacemaker should strictly avoid MRI scans and metal detectors.

Reason : Prosthetic cardiac pacemaker consists of a pulse generator, lead as a wire and an electrode for normal restoration of heart beat in a patient.

26. **Assertion :** The cardiac output is equivalent to the total body blood volume.

Reason : The cardiac output is amount of blood pumped by each ventricle per minute and about 5L.

27. **Assertion :** pH of blood in veins is more than that in arteries.

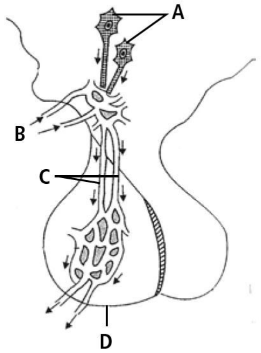
Reason : Blood in veins is more acidic as compared to the blood present in arteries.

28. **Assertion :** Frogs and snakes pump out mixed blood, *i.e.*, both oxygenated and deoxygenated.

Reason : Amphibians and reptiles have 3-chambered heart.

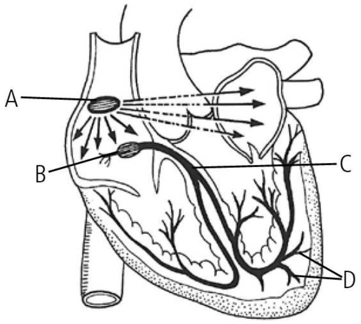
Figure Based Questions

29. Refer to the given figure and answer the following questions.



(a) What does the given figure depict?
(b) Label the parts A, B, C and D.
(c) What is the purpose of this type of circulation?

30. Refer to the given figure and answer the following questions.



(a) Identify the parts labelled as A, B, C and D.
(b) What are the functions of part A and B?
(c) How is the part A affected by hormones?

CHAPTER-19 : EXCRETORY PRODUCTS AND THEIR ELIMINATION

Multiple Choice Questions

1. The cells present in the space between macula densa and afferent and efferent arterioles in juxtaglomerular apparatus are called
(a) lacis cells (b) podocytes
(c) juxtaglomerular cells (d) endothelial cells.

2. Which of the following statements is incorrect about female urethra?
(a) It is about 4 cm long and carries only urine.
(b) There is no differentiation on the basis of regions.
(c) It opens behind the vaginal aperture by a urinary aperture.
(d) It starts at the base of the trigone present in the urinary bladder.

3. The filtration pressure exerted by the filtrate in Bowman's capsule against the filtration membrane is called
(a) glomerular blood hydrostatic pressure
(b) capsular hydrostatic pressure
(c) blood colloidal osmotic pressure
(d) net filtration pressure.

4. In the distal convoluted tubules, water and sodium ions are reabsorbed from the filtrate under the influence of (i) and (ii) respectively. Hence, the filtrate becomes (iii) .

	(i)	(ii)	(iii)
(a)	antidiuretic hormone	aldosterone	isotonic
(b)	aldosterone	antidiuretic hormone	hypotonic
(c)	renin	aldosterone	hypotonic
(d)	antidiuretic hormone	renin	hypertonic

5. Which of the following options is mismatched with its function?
(a) Juxtaglomerular cells - Secretion of renin
(b) Macula densa cells - Reabsorption of salts by active transport

(c) Juxtamedullary nephrons - Control plasma volume during water shortage
(d) Atrial natriuretic factor - Inhibits NaCl reabsorption by the collecting duct and reduces secretion of aldosterone

6. The inflammation of the renal pelvis and medullary tissue of the kidney is called
(a) renal calculi (b) oliguria
(c) pyuria (d) pyelonephritis.

7. The glomerular filtration rate in healthy individual is about
(a) 125 mL/min (b) 650 mL/min
(c) 180 mL/min (d) 220 mL/min.

8. In the proximal convoluted tubule, sulphates and creatinine are
(a) reabsorbed by secondary active transport
(b) reabsorbed by primary active transport
(c) reabsorbed by diffusion
(d) not reabsorbed.

9. The external sphincter of the urinary bladder is
(a) made of detrusor muscle and is under involuntary control
(b) made of skeletal muscle and is under voluntary control
(c) made of detrusor muscle and is under voluntary control
(d) made of circular muscle fibres and is under involuntary control.

10. The gradient of increasing osmolarity towards the inner medullary interstitial fluid is maintained by
(a) counter current mechanism in the loop of Henle and vasa recta
(b) proximity between the loop of Henle and vasa recta
(c) isotonic filtrate in the descending limb of loop of Henle
(d) both (a) and (b).

11. Read the following statements and select the incorrect option.
(i) CAPD is alternative to haemodialysis and is considerably less expensive.
(ii) First kidney transplant in India was performed on December 1, 1971.
(iii) Transplanted kidney may function for 2 years only.
(iv) Rennin converts the protein angiotensinogen into angiotensin.
(v) Chloride ions and urea are reabsorbed by diffusion in PCT.
(a) (i), (iii) and (v) only (b) (iii) and (iv) only
(c) (i), (ii) and (iv) only (d) (i) only

12. A patient suffering from glycosuria shows
(a) presence of glucose in urine
(b) diabetes mellitus
(c) presence of haemoglobin in urea
(d) both (a) and (b).

13. Enzyme arginosuccinate synthase in ornithine cycle catalyses the reaction for
(a) formation of arginine and fumarate
(b) formation of citrulline
(c) condensation of citrulline with aspartate
(d) formation of carbamoyl phosphate.

14. The statement that is incorrect about tubular secretion is
(a) it is the step in the process of filtering blood to produce urine
(b) ammonia, hydrogen ions and potassium are secreted in the filtrate in distal convoluted tubules by active transport
(c) urea enters the filtrate in ascending limb of loop of Henle by diffusion
(d) creatinine, hippuric acid and drugs are secreted into the filtrate in distal convoluted tubule.

15. The part of the kidney present between two medullary pyramids is called
(a) major calyx (b) minor calyx
(c) renal column of Bertin (d) renal papilla.

Match The Columns

16. Match the column I with column II.

	Column I		**Column II**
A.	Uricotelism	(i)	Spiders
B.	Aminotelism	(ii)	Star fish
C.	Ureotelism	(iii)	Salamanders
D.	Guanotelism	(iv)	Turtles
E.	Ammonotelism	(v)	Lizards

17. Match the column I with column II. (There can be more than one match for items in column I.

	Column I		**Column II**
A.	Glomerular blood hydrostatic pressure	(i)	Total pressure that promotes filtration
B.	Capsular hydrostatic pressure	(ii)	32 mm Hg
C.	Blood colloidal osmotic pressure	(iii)	18 mm Hg
D.	Net filtration pressure	(iv)	Blood pressure in glomerulus
		(v)	60 mm Hg
		(vi)	10 mm Hg
		(vii)	Pressure exerted by plasma proteins
		(viii)	Pressure against filtration membrane

Passage Based Questions

18.(A) Complete the given passage with appropriate words.

Apart from kidneys, other organs play a vital role in the waste removal from the body. Lungs remove about (i) litres of CO_2 per hour. (ii) and (iii) glands secrete sweat and sebum respectively. Sweat has a pH of (iv) and contains water, urea, NaCl, etc. Sebum removes (v) from the body. (vi) is formed in the liver that is passed out through kidneys whereas cholesterol (vii) pigments, some (viii) and many drugs excreted by the liver are passed out through the faeces. Epithelial cells of intestine excrete salts such as (ix) and calcium. (x) glands excrete harmful substances such as mercury and thiocyanate.

(B) Read the given passage and correct the errors, wherever present.

The functioning of kidney is under the control of hormones and juxtaglomerular apparatus. Aldosterone is released by the posterior lobe of pituitary gland into the blood to increase secretion of water in the DCT and collecting tubules of kidneys. The release of this hormone is triggered when the osmoreceptors present in the pituitary gland detect an increase in osmolarity above 600 mOs molL^{-1}. Renin is the enzyme secreted by JGA into the blood stream that changes angiotensin to angiotensinogen. This hormone constricts the arterioles to increase blood volume and stimulates DCT to reabsorb more NaCl and water by stimulating adrenal glands to release antidiuretic hormone. Atrial natriuretic factor is released from the ventricles of heart in response to decrease in blood volume and pressure. This factor stimulates the release of renin from JGA and hence regulates the osmolarity, pressure and volume of blood.

Assertion & Reason

In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :

(a) If both A and R are true and R is the correct explanation of A.
(b) If both A and R are true but R is not the correct explanation of A.
(c) If A is true but R is false. (d) If A is false but R is true.

19. **Assertion :** Alcoholics suffer from frequent urination and dehydration.

Reason : High level of alcohol in blood leads to inhibition of release of ADH from pituitary gland.

20. **Assertion :** Sympathetic nerve stimulation causes emptying of urinary bladder.

Reason : Stimulation of sympathetic nerve relaxes the detrusor muscle and constricts the internal sphincter.

21. **Assertion :** Animals living in dry conditions conserve water by synthesising uric acid crystals from ammonia.

Reason : Uric acid crystals are least soluble in water.

22. **Assertion :** Urinary tract infections are more common in females than in males.

Reason : In females, urethra is much shorter than in males, so the bacteria can easily reach the urinary bladder.

23. **Assertion :** A haemodialyser is used to purify the blood of a person with completely damaged or non-functional kidneys.

Reason : The dialysing fluid in a haemodialyser contains the same quantities of electrolytes, nutrients and nitrogenous wastes as normal blood plasma.

24. **Assertion :** Counter current mechanism in the kidneys help in concentrating the urine upto four times than the initial filtrate.

Reason : Counter current mechanism increases the concentration of NaCl in the interstitial fluid which causes water to diffuse out of collecting duct.

25. **Assertion :** The parietal layer of the Bowman's capsule have peculiar cells called podocytes.

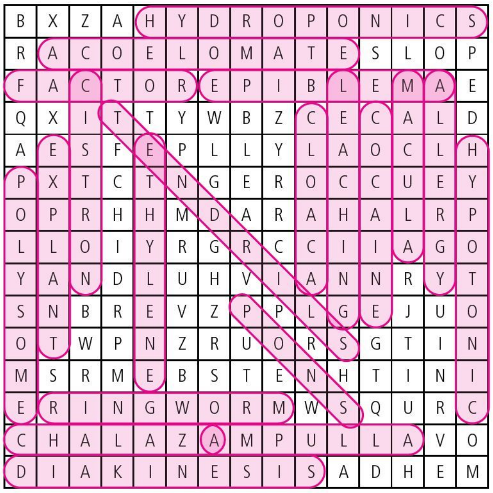
Reason : Podocytes have pedicels which possess slit pores through which the glomerular filtrate filters.

26. **Assertion :** The pH of a person's urine tends to decrease after consuming high protein diet.

Reason : A high-protein diet leads to uric acid formation, thus making the urine acidic.

Contributed by : Rakesh Patial

SOLUTIONS TO FEBRUARY 2023 WORD GRID



B	X	Z	A	H	Y	D	R	O	P	O	N	I	C	S
R	A	C	O	E	L	O	M	A	T	E	S	L	O	P
F	A	C	T	O	R	E	P	I	B	L	E	M	A	E
Q	X	I	T	T	Y	W	B	Z	C	E	C	A	L	D
A	E	S	F	E	P	L	L	Y	L	A	O	C	L	H
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O	P	R	H	H	M	D	A	R	A	H	A	L	R	P
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Y	A	N	D	L	U	H	V	I	A	N	N	R	Y	T
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O	T	W	P	N	Z	R	U	O	R	S	G	T	I	N
M	S	R	M	E	B	S	T	E	N	H	T	I	N	I
E	R	I	N	G	W	O	R	M	W	S	Q	U	R	C
C	H	A	L	A	Z	A	M	P	U	L	L	A	V	O
D	I	A	K	I	N	E	S	I	S	A	D	H	E	M

1. Macula
2. Pons
3. Ampulla
4. Tendrils
5. Allergy
6. Polysome
7. Explant
8. Leaching
9. Acoelomate
10. Ethylene
11. Cloaca
12. Chalaza
13. Hydroponics
14. Factor
15. Epiblema
16. Cocaine
17. Diakinesis
18. Hypotonic
19. Cistron
20. Ringworm

27. **Assertion :** In renal failure, kidneys are unable to convert vitamin D to calcitriol.

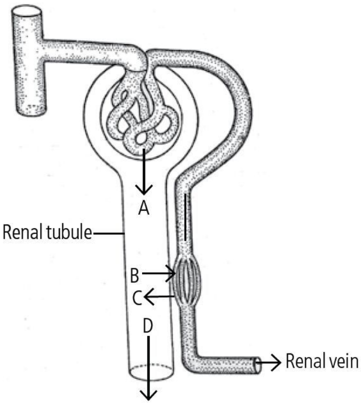
Reason : Renal failure can lead to osteomalacia in individuals.

28. **Assertion :** The excretory and regulatory functions of kidneys are mainly carried out by cortical nephrons.

Reason : Cortical nephrons control the plasma volume when body has low water content.

Figure Based Questions

29. Refer to the given figure depicting urine formation and answer the following questions.



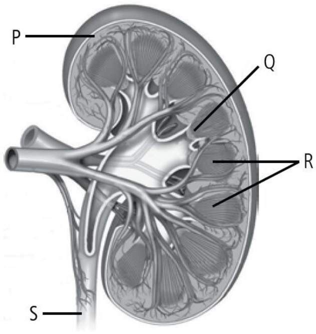
(a) Identify the processes marked as A, B, C and D in the given figure.

(b) What are the three intrinsic mechanisms that make process A autoregulated?

(c) What changes does the filtrate undergo in the loop of Henle?

(d) What is the final chemical composition of fluid eliminated by process D?

30. Refer to the given figure and answer the following questions.



(a) Identify the parts labelled as P, Q, R and S.

(b) What is the structural and functional unit of kidney and how many of them are present in one kidney?

(c) Give a brief description of part R and part S.

SOLUTIONS

CHAPTER-18 : BODY FLUIDS AND CIRCULATION

1. (b) **2.** (a) **3.** (d) **4.** (c) **5.** (c)
6. (b) **7.** (a) **8.** (c) **9.** (b) **10.** (b)
11. (b) **12.** (d) **13.** (d) **14.** (a) **15.** (c)

16. A-(iii); B-(iv); C-(i); D-(ii); E-(v)

17. A-(iv, viii); B-(ii, x); C-(vi, vii); D-(iii, v); E-(i, ix)

18.(A) (i) cardiac
(ii) atrial
(iii) SA
(iv) bicuspid
(v) tricuspid
(vi) ventricular
(vii) pulmonary
(viii) semilunar
(ix) ventricular
(x) ventricles

(B) The hepatic portal circulation is the flow of ~~oxygenated~~ deoxygenated blood from the digestive organs to the ~~lungs~~ liver before it reaches the heart. The hepatic ~~vein~~ artery supplies oxygenated blood from abdominal aorta and hepatic ~~artery~~ vein carries deoxygenated blood from digestive organs. ~~Gastric~~ Cystic vein opens directly into hepatic portal vein and drains blood from the gall bladder. All these veins open into ~~hypophysial~~ hepatic portal vein that open into ~~superior~~ inferior vena cava. Through this portal system the liver provides glucose to the body in case of low blood glucose level and converts ~~urea~~ ammonia into ~~ammonia~~ urea to detoxify the blood.

19. (a) **20.** (a) **21.** (b) **22.** (d) **23.** (a)
24. (b) **25.** (b) **26.** (b) **27.** (d) **28.** (a)

29. **(a)** The given figure is of human hypophysial portal system present in the brain.

(b) A - Neurosecretory cells in hypothalamus
B - Hypophysial arteries
C - Hypophysial portal veins
D - Anterior lobe of pituitary gland

(c) This system is composed of two capillary plexus interconnected by portal veins, which take blood from one organ to other, before blood is returned to the heart. Its purpose is to act as "shunt" that takes venous blood carrying regulatory hormones from hypothalamus directly to the anterior pituitary before blood continues its path back to the heart.

30. **(a)** A - SA node, B - AV node, C - Bundle of His, D - Purkinje fibres.

(b) SA node or the sinoatrial node is a neuromuscular tissue that is the pace maker. The heart beat originates from SA node that lies in the wall of the right atrium. AV node or the atrioventricular node is the pace setter. It picks up the wave of contraction that starts from the SA node. It further relays the wave to rest of the heart through bundle of His and Purkinje fibres. Bundle of His and Purkinje fibres convey impulse of contraction from AV node to the myocardium of the ventricles.

(c) Adrenal medulla secretes adrenaline and nor-adrenaline hormones. Adrenaline accelerates the hear beat under emergency situations whereas nor-adrenaline does the same under normal conditions by directly influencing the SA node.

CHAPTER-19 : EXCRETORY PRODUCTS AND THEIR ELIMINATION

1. (a) **2.** (c) **3.** (b) **4.** (a) **5.** (b)
6. (d) **7.** (a) **8.** (d) **9.** (b) **10.** (d)
11. (b) **12.** (d) **13.** (c) **14.** (d) **15.** (c)

16. A-(v); B-(ii); C-(iv); D-(i); E-(iii)

17. A-(iv, v); B-(iii, viii); C-(ii, vii); D-(i, vi)

18.(A) (i) 18 (ii) Sudoriferous
(iii) sebaceous (iv) 4.5
(v) lipids (vi) Urea
(vii) bile (viii) vitamins
(ix) iron (x) Salivary

(B) The functioning of kidney is under the control of hormones and juxtaglomerular apparatus. ~~Aldosterone~~ Antidiuretic hormone is released by the posterior lobe of pituitary gland into the blood to increase ~~secretion~~ reabsorption of water in the DCT and collecting tubules of kidneys. The release of this hormone is triggered when the osmoreceptors present in the ~~pituitary gland~~ hypothalamus detect an increase in osmolarity above ~~600~~ 300 mOsmolL^{-1}. Renin is the enzyme secreted by JGA into the blood stream that changes ~~angiotensin~~ angiotensinogen to ~~angiotensinogen~~ angiotensin II. This hormone constricts the arterioles to increase blood ~~volume~~ pressure and stimulates DCT to reabsorb more NaCl and water by stimulating adrenal glands to release ~~antidiuretic~~ aldosterone hormone. Atrial natriuretic factor is released from the ~~ventricles~~ atria of heart in response to ~~decrease~~ increase in blood volume and pressure. This factor ~~stimulates~~ inhibits the release of renin from JGA and hence regulates the osmolarity, pressure and volume of blood.

19. (a) **20.** (d) **21.** (b) **22.** (a) **23.** (c)
24. (a) **25.** (d) **26.** (a) **27.** (b) **28.** (c)

29. **(a)** In the given figure, A is Glomerular filtration, B is Tubular reabsorption, C is Tubular secretion and D is Excretion.

(b) Glomerular filtration is autoregulated by three mechanisms. (i) Myogenic mechanism where increase in blood pressure in arterioles increases the blood flow in glomerulus and *vice versa*. (ii) Juxtaglomerular mechanism where (JGA) cells secrete renin that regulates the glomerular filtration rate. (iii) Sympathetic nerve fibres, when stimulated cause constriction of renal arteries and hence, decreases the glomerular filtration rate.

(c) As filtrate flows in the descending limb of loop of Henle, the water gets reabsorbed while sodium and other solutes are not reabsorbed. This makes the filtrate hypertonic to blood plasma. In the ascending limb, the water does not pass through, but K^+, Cl^-, Na^+ and Mg^{2+} are reabsorbed in the thick part. It is also partially permeable to urea. This makes the filtrate hypotonic to blood plasma.

(d) Urine is composed of 95% water and 5% other substances that are organic and inorganic. Organic substances include urea, creatinine, creatine, ammonia, uric acid, amino acids, hormones, vitamins, etc., and inorganic substances include chloride, phosphate, sulphate, potassium ions, etc.

30. **(a)** In the given figure, P is Cortex, Q is Renal papilla, R is Medullary pyramids and S is Ureter.

(b) The structural and functional unit of kidney is nephron. There are about 10,00,000 nephrons in a single kidney.

(c) Part R are the conical areas called medullary pyramids present in inner medulla region of kidney. Their broad base is towards the cortex and each pyramid terminates into a structure called renal papilla. Part S, the ureter is 25 to 30 cm long, tubular structure that leaves the kidney from the renal pelvis in the hilus region. It is made up of transitional epithelium and carries urine from kidneys to the urinary bladder.

* * *

TRIO

The same THREE LETTERS will complete these four words.

Can you find the three-letter sequence?

S _ _ _ EN
ATRI _ _ _ X
_ _ _ URA
COU _ _ _ T

Readers can send their responses at editor@mtg.in or post us with complete address by 10th of every month.
Winners' names will be published in next issue.

ZOOM IN BI

The syllabus of biology for boards and competitive exams is very vast which impedes students from acquiring indepth knowledge and covering the entire syllabus at the same time. An important topic for biology is therefore presented here in elaborate form to enable students grasp the topic.

HUMAN GENETIC DISORDERS

Genetic disorders are due to changes or alterations in the genetic material.

Human Genetic Disorders

Chromosomal disorders

These genetic disorders are caused due to absence or excess or abnormal arrangement of one or more chromosomes. These are non-heritable and pedigree analysis of a family does not help in tracing the pattern of inheritance of such chromosomal disorders. These are of two types: abnormalities due to **aneuploidy** and **aberrations** either in autosomes or in sex chromosomes.

Mendelian disorders

These are gene related human disorders determined by mutations in single gene. They are transmitted to the offspring as per Mendelian principles. The pattern of inheritance of such Mendelian disorders can be traced in a family by the **pedigree analysis**.

CHROMOSOMAL DISORDERS

Variations in the number of chromosomes result from non-disjunction, *i.e.*, failure of chromosomes to separate or move to opposite poles during division. Due to non-disjunction, abnormal gamete may get both the chromosomes or none at all. Chromosomal defects can be detected through amniocentesis. These disorders are rarely transmitted.

Autosomal Abnormalities

These are due to autosomal aneuploidy (gain or loss of one or more chromosomes, but not a complete set) and aberrations.

	Disorder	Aberration	Genotype	Symptoms
1.	Down's syndrome (Mongolism)	Trisomy of 21-chromosome	47 chromosomes (45+XY in male, 45 + XX in female)	Rounded face, protruding and furrowed tongue which causes mouth to remain partially open, short neck, flat hands with small fingers, low IQ (< 40), gonads and genitalia are undeveloped. The risk of having child with Down's syndrome increases with increase in mother's age.
2.	Edward's syndrome	Trisomy of 18-chromosome	47 chromosomes	These infants are smaller than the average newborn, mental retardation, low set deformed ears, webbed neck, congenital dislocation of hips, receding chin. Patient dies within 6 months after birth.
3.	Patau's syndrome	Trisomy of 13-chromosome	47 chromosomes	Mental retardation, low set deformed ears, deafness, deformed fingers, cryptorchidism, abnormal cleft lip and palate, small chin. The average life span of the affected person is about 4 months.
4.	Cri-du-chat (Cat cry) syndrome	Deletion of half part in short arm of chromosome 5	46 chromosomes	The affected newborn cries like mewing of a cat. Infant exhibits gastrointestinal and cardiac complications, often mentally retarded. Abnormal development of glottis and larynx, thus, cry like cat.
5.	Myelogenous leukemia	Reciprocal translocation, *i.e.*, deletion of some portion of long arm of chromosome 22 and its addition to chromosome 9	46 chromosomes	It changes conformation of C-Abl protein and activates a latent oncogenic potential causing production of excess of granular leucocytes. Hence, called chronic granulytic leukemia or chronic myeloid leukemia (CML). The deficient 22 chromosome whose little segment from long arm is deleted is called **Philadelphia chromosome**, as it was first reported in city of Philadelphia.

Sex Chromosomal Abnormalities

Turner's Syndrome

- It occurs due to monosomy (2n–1). It involves union of an allosome free egg (22 + 0) and normal X-sperm or a normal egg and an allosome free sperm (22 + 0). The individual has 2n = 45 (44 + X0), instead of 46.
- Females are sterile, have rudimentary ovaries, filled with connective tissues, small uterus, undeveloped breasts, short stature, webbed neck, abnormal intelligence, cardiovascular abnormality and hearing impairment.
- They may not menstruate or ovulate.

Klinefelter's Syndrome

- It is due to trisomy of sex (X) chromosome. It is formed by union of an abnormal XX egg and normal Y sperm or normal X egg and abnormal XY sperm. The individual has 47 chromosomes, (44+XXY).
- Such persons are sterile males with undeveloped testes, mental retardation, sparse body hair like females, knock knees,feminine pitched voice and enlarged breasts (gynaecomastia).

Superfemale (Poly X female syndrome)

- Individuals have 47 (44 + XXX), 48 (44 + XXXX) or 49 (44 + XXXXX) chromosomes.
- Females are mentally retarded and show abnormal sexual development.
- The number of barr bodies is one less than total number of X chromosomes.

Supermale (Poly Y male syndrome)

- Affected individuals have 47 (44 + XYY) chromosomes.
- Males are abnormally tall, mentally retarded, have criminal mindset (criminal or Jacob's syndrome). Show overproduction of male sex hormone and are more aggressive than normal males.
- Show normal sexual functions, fertility and genitalia.

MENDELIAN DISORDERS

It can be due to gene mutations in autosomes or in sex chromosomes.

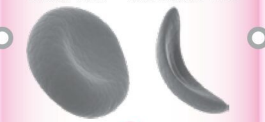
Gene Mutations in Autosomes

These are of two types: recessive and dominant traits.

Recessive Traits are caused by recessive autosomal genes when present in homologous conditions. Some of the recessive diseases are described below:

Sickle cell anaemia: It is an autosomal hereditary disorder in which erythrocytes become sickle shaped under oxygen deficiency during strenuous exercise and at high altitudes.

In affected individuals, RBCs become elongated and curved because of polymerisation of haemoglobin.


Normal Red Blood Cell
Sickle Shaped Red Blood Cell

Sickle cell crisis, if treated, affects kidneys, muscles, joints, lungs and gastrointestinal tract.

Affected individuals suffer attacks when red blood cell aggregates in the venous side of capillary system, where oxygen tension is very low. As a result, variety of tissues may get deprived of oxygen and suffer severe damage.

Affected individuals are anaemic because their erythrocytes are destroyed more rapidly then normal RBCs.

- Sickle cell anaemia is caused by the formation of an abnormal haemoglobin called Hb-S.
- Haemoglobin-S differs from normal haemoglobin-A in only one amino acid *i.e.*, 6th amino acid of β chain. Here, glutamic acid is replaced by valine due to substitution (transversion) of T by A in the second position of the triplet codon (CTC) which is changed to CAC. The gene is situated on chromosome 11.The codon CTC is transcribed into GAG (coding for glutamic acid), but due to substitution of T by A, the new codon CAC is transcribed into GUG that codes for valine. Valine forms hydrophobic bonds with complementary sites of other globin molecules. It distorts their configuration. As a result, erythrocytes having haemoglobin-S become sickle-shaped.

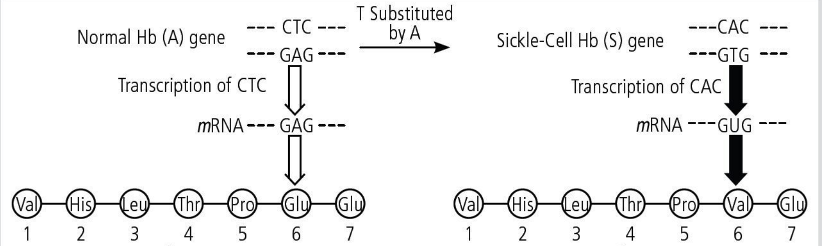
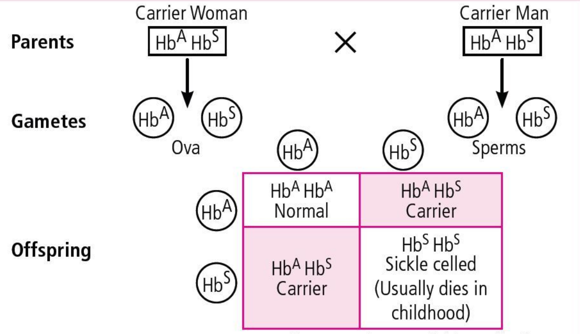

Normal Hb (A) gene
--- CTC ---
--- GAG ---
T Substituted by A
Sickle-Cell Hb (S) gene
---CAC ---
---GTG ---
Transcription of CTC
mRNA --- GAG ---
Transcription of CAC
mRNA ---GUG ---
Val His Leu Thr Pro Glu Glu
1 2 3 4 5 6 7
HbA Peptide
Val His Leu Thr Pro Val Glu
1 2 3 4 5 6 7
HbS Peptide

Fig.: β-chain peptide in Hb^A and Hb^S

- The gene for sickle-celled erythrocytes is represented by Hb^S while that of normal erythrocytes is written as Hb^A. The homozygotes for the two types are Hb^S Hb^S and Hb^A Hb^A. The heterozygotes are written as Hb^A Hb^S. When two sickle cell heterozygotes marry, they produce three types of children-homozygous normal, heterozygous carrier and homozygous sickle celled in the ratio of 1 : 2 : 1. However, homozygous sickle-celled individuals (Hb^S Hb^S) die in childhood (before reproductive age) due to acute anaemia. Therefore, a ratio of one normal to two carriers is obtained.
- The allele for sickle-cell anaemia has survival value in malaria infested areas like tropical Africa. Malarial parasite is unable to penetrate the erythrocyte membrane and thus, do not cause any harm.


Parents
Carrier Woman
HbA HbS
×
Carrier Man
HbA HbS
Gametes
HbA
HbS
Ova
HbA
HbS
Sperms
HbA
HbS
HbA
HbS
Offspring
HbA HbA Normal
HbA HbS Carrier
HbA HbS Carrier
HbS HbS Sickle celled (Usually dies in childhood)

1 Normal : 2 Carrier : 1 Sickle celled

A cross between two sickle cell carriers in human beings to show that the gene is lethal in the homozygous state

Thalassemia: It is an autosomal recessive blood disease, which appear in children of two unaffected carriers (heterozygous parents).

- The defect occurs due to mutation or deletion of genes controlling the formation of globin chains (commonly α and β) of haemoglobin.
- Imbalanced synthesis of globin chains of haemoglobin causes anaemia.

Types of Thalassemia

Depending on globin chain affected

Alpha Thalassemia

- Defective formation of α-globin, controlled by two genes present on chromosome 16, HBA1 and HBA2 with total of 4 alleles.
- Persons with one defective allele are silent carriers while two defective alleles produce **α-thalassemia minor**. Three defective alleles cause accumulation of β-chain tetramers called **haemoglobin Barts** (γ_4) in infants and **haemoglobin H** (β_4) in adults.
- There is anaemia, jaundice, hepatosplenomegaly and bone changes. All the defective alleles kill the fetus (hydrops fetalis) resulting in still birth or death soon after delivery.

Beta Thalassemia

- Decreased synthesis of β-globin. Defect is due to alleles of HBB gene present on chromosome 11.
- Persons with one defective allele suffer from **thalassemia minor** with larger number of microcytic erythrocytes and lesser amount of haemoglobin. Persons with both the defective alleles suffer from **Cooley's anaemia** or **thalassemia major**.
- There is severe haemolytic anaemia, hepatosplenomegaly, cardiac enlargement and skeletal deformities.

Delta Thalassemia

- It occurs due to defective allele of HBD gene present on chromosome 11.
- The effect of this thalassemia is minor, as only 3% haemoglobin in adults consists of α and δ chains.

Cystic Fibrosis

Autosomal recessive disorder

- The disease gets its name from fibrous cysts that appear in pancreas.
- It is due to recessive autosomal allele on chromosome 7.
- It produces defective glycoprotein, which causes formation of thick mucus in skin, lungs, pancreas, liver, etc.
- Sweat of the patient contains very high level of Na^+ and Cl^-. There is failure of chloride ion transport mechanism in cell surface membrane of epithelial cell.
- Accumulation of thick mucus in lungs results in obstruction of airways.
- There is maldigestion of food and high fat content in stool, liver cirrhosis, impaired bile production.
- There is recurrent pulmonary infection and irreversible lung damage. Mucus deposition in pancreas blocks secretion of pancreatic juice.
- In males, vasa deferentia atrophies.

Alkaptonuria : It is an inherited autosomal recessive metabolic disorder.

Cause

- It is due to deficiency of an oxidase enzyme required for breakdown of tyrosine, which results in accumulation of toxic byproduct homogentisic acid (alkapton).
- Lack of the enzyme is due to the absence of normal form of gene on chromosome 3 that controls the synthesis of the enzyme. Hence, homogentisic acid accumulates in the tissues and is also excreted in the urine.

Symptoms

- Heart valves, cartilages (ochronosis), capsules of joints, ligaments and tendons are majorly affected.
- If the urine of these patients is allowed to stand for some hours in air, it turns black due to oxidation of homogentisic acid. AA and Aa are normal, but aa is alkaptonuric.

Treatment

- Nitisinone drug gives relief.

Albinism: It is an autosomal recessive genetic disorder.

Cause

- Absence of enzyme **tyrosinase** causes albinism. Tyrosinase is required for the synthesis of melanin pigment from dihydroxyphenylalanine.
- The gene for albinism (a) does not produce the enzyme tyrosinase but its normal allele (A) does. Thus, only homozygous recessive individual (aa) is affected by this disease.

Symptoms

- Albinos (individuals with albinism) lack dark pigment **melanin** in the skin, hair and iris. Although albinos have poor vision yet they lead normal life.

Tay-Sach's Disease (TSD)/Infantile Amourotic Idiocy: It is an autosomal, recessive genetic disorder.

Cause

- It is caused by the enzyme β-D-N-acetyl hexosaminidase which in normal individuals exists in two forms A and B.

Symptoms

- Children with Tay-Sach's disease are born normal but develop severe brain and spinal cord damage later in few months due to an error in fat metabolism.
- Homozygous children show degeneration of central nervous system due to accumulation of fatty substance (sphingolipid) in nerve cells.
- The mentally retarded and progressively paralysed child dies in 3 to 4 years.
- There is no treatment for this disease and hence no survivors.

Gaucher's Disease : It is an autosomal recessive genetic disorder.

Cause

- It is caused by an autosomal recessive gene present on chromosome 1.
- Breakdown of fatty acid substance cerebroside is impaired leading to accumulation of lipid materials in body tissue and blood.

Symptoms

- There is enlargement of spleen, liver and expansion of limb bones. Activity of an enzyme glucocerebrosidase is inhibited in lysosome, resulting in accumulation of cerebroside.

Dominant Traits : These area caused by dominant autosomal genes.

Some disorders are:

Achondroplasia

- A form of dwarfism in which long bones do not grow.

Polydactyly

- Presence of extra fingers and toes.

Brachydactyly

- Abnormal short fingers and toes.

Aniridia

- Absence of iris in eye.

Neurofibromatosis

- Tumor like growths on body.

Huntington's chorea

- A disorder in which muscle and mental deterioration occurs. There is gradual loss of motor control resulting in uncontrollable shaking and dance like movements (chorea). The brain shrinks between 20-30% in size followed by slurring of speech, loss of memory and hallucinations. The defective gene is dominant autosomal, located on chromosome 4. This defective gene has 42-100 repeats of CAG instead of 10-34 repeats in normal gene.

Alzheimer's Disease

- This neuro-degenerative disease of brain is caused by the accumulation of amyloid protein plaques in the brain resulting in the degeneration of neurons. Choline acetyl transferase activity is impaired.
- The protein involved, **amyloid-β peptide**, is produced and processed in a number of ways in the brain. This disease is due to ageing and involvement of two defective autosomal alleles, one on the chromosome 21 and other on chromosome 19.
- This disease is characterised by dementia (mental deterioration) leading to loss of memory.
- A bacteriophage spray has been found to reduce the impact of the disease.

B. Gene Mutations in Sex Chromosomes

- Sex-linked disorders are genetic disorders produced by changes in sex chromosomes.

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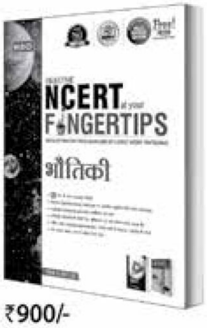
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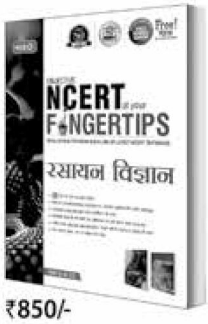
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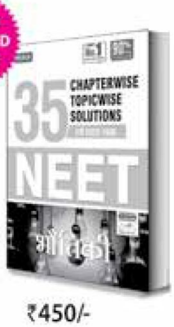
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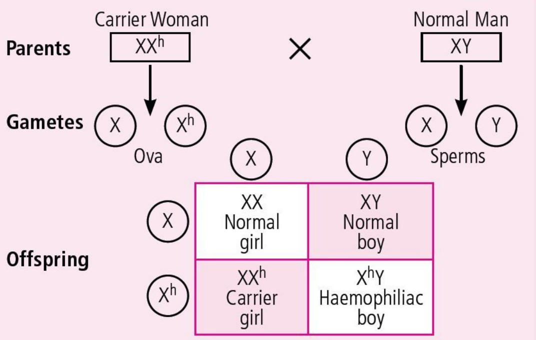
X-linked recessive disorders

Haemophilia: It is also called bleeder's disease as patient continues to bleed even from a minor cut, due to absence of clotting factors, **factor VIII** or antihaemophilic globulin (haemophilia-A) and **plasma thromboplastin factor IX** (haemophilia-B, Christmas disease).

A person may die of blood loss due to continuous bleeding.

Conditions:



Carrier Woman
Normal Man
Parents
XX^h
×
XY
Gametes
X
X^h
Ova
X
Y
Sperms
X
Y
X
X^h
Offspring
XX Normal girl
XY Normal boy
XX^h Carrier girl
X^hY Haemophiliac boy

1 Normal girl : 1 Carrier girl
1 Normal boy : 1 Haemophilic boy

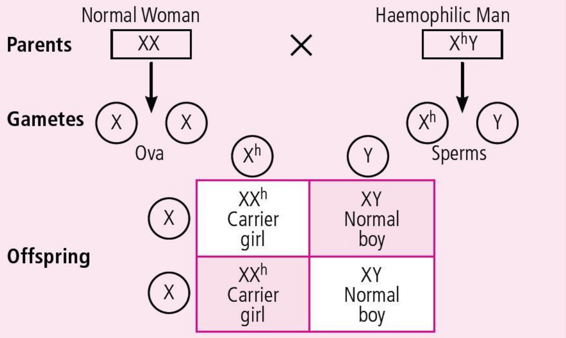
Inheritance of haemophilia by 50% of the male children when the mother is carrier and the father is normal.

Genotype of haemophiliac person

Carrier female
- A female having only one allele for haemophilia (XX^h) appears normal because the allele for normal blood clotting present on the other X-chromosome is dominant. Such females are known as carriers.

Affected male
- A single gene for the defect gets expressed, as Y-chromosome is devoid of any corresponding allele (X^hY).

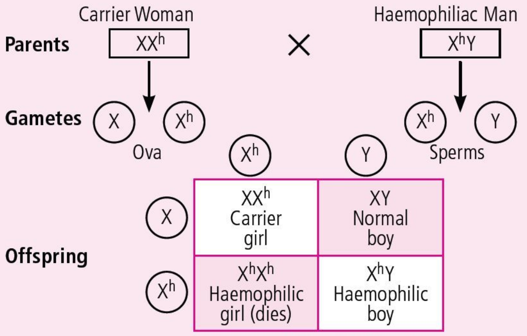
Affected female
- Haemophilia is genetic disorder which occurs due to the presence of a recessive sex linked gene *h*, carried by X-chromosome. A female becomes haemophilic only when both its X-chromosomes carry the gene (X^h X^h). However, such females generally die before birth because the combination of these two recessive alleles is lethal.



Normal Woman
Haemophilic Man
Parents
XX
×
X^hY
Gametes
X
X
Ova
X^h
Y
Sperms
X^h
Y
X
X
Offspring
XX^h Carrier girl
XY Normal boy
XX^h Carrier girl
XY Normal boy

2 Carrier girls : 2 Normal boys

Production of normal children when the father is haemophilic and the mother is normal. This is because the X-chromosome of the male carrying the defective gene is passed on to the daughter who becomes carrier.



Carrier Woman
Haemophiliac Man
Parents
XX^h
×
X^hY
Gametes
X
X^h
Ova
X^h
Y
Sperms
X^h
Y
X
X^h
Offspring
XX^h Carrier girl
XY Normal boy
X^hX^h Haemophilic girl (dies)
X^hY Haemophilic boy

1 Haemophilic girl (dies):
1 Carrier girl : 1 Haemophilic boy
1 Normal boy

Children of carrier mother and haemophilic father.

There is a no permanent cure for haemophilia. Bleeding can be checked by transfusion of normal blood, as it provides the vital factors for blood clotting.

Colour blindness: It is recessive sex-linked trait. Individual fails to distinguish red and green colours.

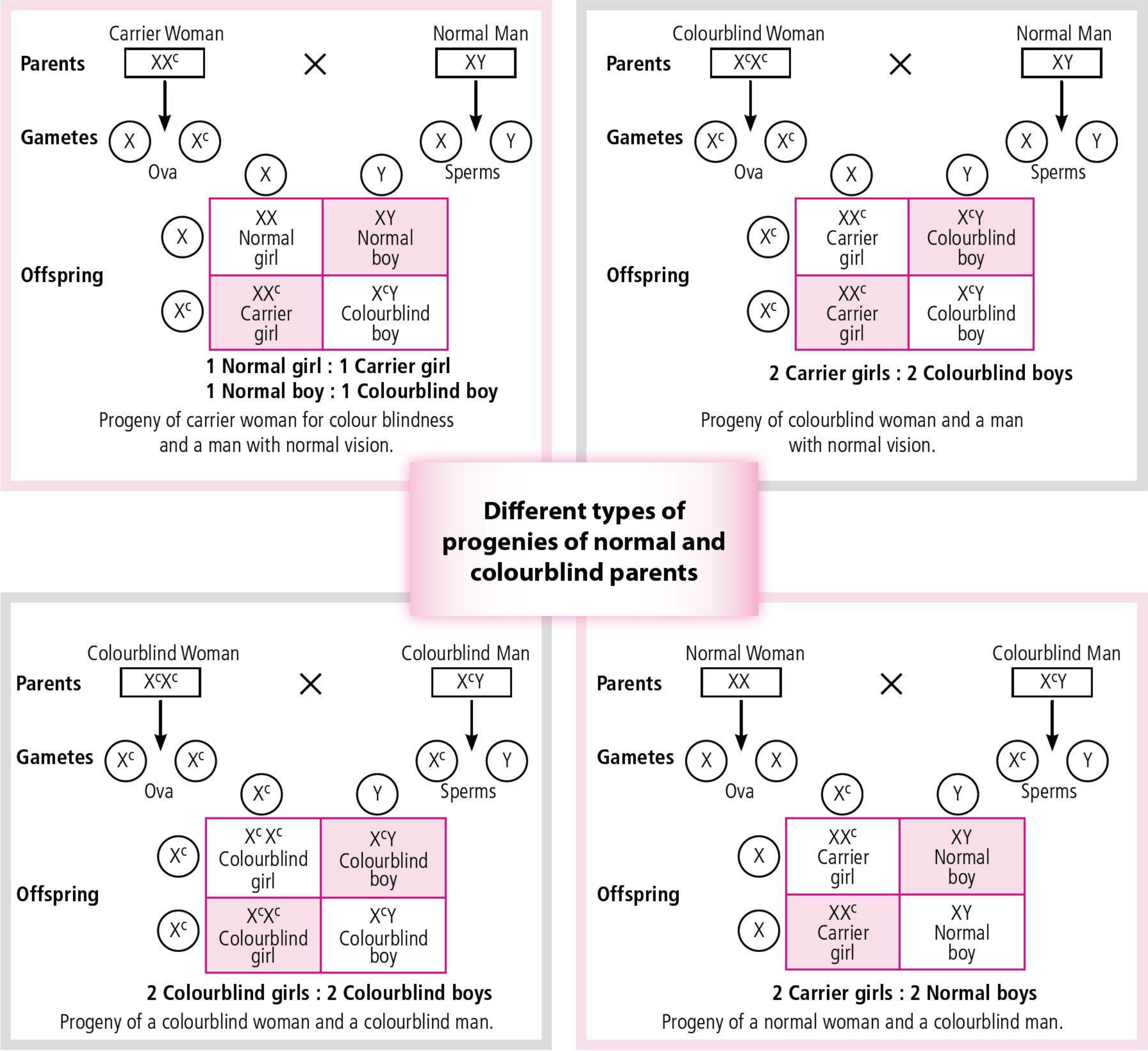
– The gene for normal vision is dominant. The normal gene and recessive alleles are carried by X-chromosomes.

Genotype of colourblind person

Affected female
In females, colour blindness appears only when both sex chromosomes carry recessive gene (X^c X^c).

Carrier female
Females have normal vision but functions as carrier if single recessive gene is present (XX^c).

Affected male
In human males, the defect appears in presence of single recessive gene (X^cY), because Y-chromosome does not carry any gene for colour vision.


Carrier Woman
Normal Man
Parents
XX^c
×
XY
Gametes
X
X^c
Ova
X
Y
Sperms
Offspring
XX Normal girl
XY Normal boy
XX^c Carrier girl
X^cY Colourblind boy
Colourblind Woman
Normal Man
Parents
X^cX^c
×
XY
Gametes
X^c
X^c
Ova
X
Y
Sperms
Offspring
XX^c Carrier girl
X^cY Colourblind boy
XX^c Carrier girl
X^cY Colourblind boy
Colourblind Woman
Colourblind Man
Parents
X^cX^c
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Gametes
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Ova
X^c
Y
Sperms
Offspring
X^cX^c Colourblind girl
X^cY Colourblind boy
X^cX^c Colourblind girl
X^cY Colourblind boy
Normal Woman
Colourblind Man
Parents
XX
×
X^cY
Gametes
X
X
Ova
X^c
Y
Sperms
Offspring
XX^c Carrier girl
XY Normal boy
XX^c Carrier girl
XY Normal boy

1 Normal girl : 1 Carrier girl
1 Normal boy : 1 Colourblind boy

Progeny of carrier woman for colour blindness and a man with normal vision.

2 Carrier girls : 2 Colourblind boys

Progeny of colourblind woman and a man with normal vision.

Different types of progenies of normal and colourblind parents

2 Colourblind girls : 2 Colourblind boys

Progeny of a colourblind woman and a colourblind man.

2 Carrier girls : 2 Normal boys

Progeny of a normal woman and a colourblind man.

Night blindness: It is caused by recessive gene carried by X-chromosome. It is more common in males. Female become night blind only if they receive two genes for defect. It is of two types:

(i) Congenital: Due to disorder that interfers with the function of retinal rods.

(ii) Acquired: Due to vitamin A deficiency.

Duchenne's Muscular Dystrophy (DMD): In this disorder, mutated gene (this is largest gene with 2400 kbp in man) present in the middle of the short arm of the X chromosome is unable to produce a protein called **dystrophin** in the skeletal muscles. The latter is believed to relay the nerve's signal to the calcium storage in the muscle cell. This protein is associated with the sarcolemma (plasma membrane of muscle) where it plays a role in transmembrane signalling and in stabilising the plasma membrane. Due to its deficiency, calcium is not released from the muscle cell. As a result, the muscle contraction does not take place. Abnormal rise of calcium levels in the muscle releases an enzyme that destroys actin and myosin resulting in fatal muscular weakness. There is deterioration of girdle muscles at an early age. The patient is unable to walk after the age of 12 followed by cardiomyopathy, mental impairment and death by the age of 20 due to cardiac or respiratory failure. It is common in males. Female heterozygous carriers are normal.

Class XII

BIO Digest

This article covers high yield facts of the given topic.

Ecosystem

- Any unit in nature which includes all the organisms interacting with each other and with the physical environment so that a flow of energy leads to clearly defined trophic structure, biotic diversity and material cycle within the system is known as an **ecosystem**.
- The term ecosystem was coined by **A.G. Tansley** in 1935.
- **Natural ecosystems** are divisible into two categories, **terrestrial** or **land ecosystems** (*e.g.*, forests, grasslands, deserts, gardens) and **aquatic** or **water ecosystems** (*e.g.*, ponds, lakes, streams, estuaries, sea).
- **Man-made ecosystems** are maintained artificially by man. For example, crop lands like maize, wheat, rice-fields, etc., and aquarium.

COMPONENTS OF ECOSYSTEM

- An ecosystem has two basic components : **abiotic** (non living) and **biotic** (living organisms). Abiotic components include inorganic substances, minerals, organic substances, and different climatic conditions like temperatures, pH, light, etc. Biotic components include producers, consumers and decomposers.
- Ecosystem is an **open system** which receives input in the form of solar energy and matter and results in synthesis of organic food. At the same time, each component of ecosystem gives out energy as well as waste matter, referred to as output. Therefore, a regular input of energy is necessary for maintenance of life upon earth.
- Ecosystem maintains a relatively **stable** state of equilibrium amongst its various components by **homeostasis**. It fluctuates within certain limits and can be controlled *via* number of controls as carrying capacity, recycling of wastes, self regulation and feedback system.

STRUCTURE OF ECOSYSTEM

- Interaction of biotic and abiotic components results in a physical structure that is characteristic for each type of ecosystem.
- **Standing crop :** It refers to the amount of living biomass or number of living organisms present in an unit area of ecosystem.
- **Standing state :** It is defined as the amount of inorganic nutrients present at any time in the soil or water of ecosystem. It may vary in each ecosystem from season to season.
- **Stratification :** It is formation of vertical layers where vegetation is dense, *e.g.*, division of 5-7 strata in tropical rainforest, *i.e.*, tall trees, canopy trees, understorey trees at top, shrub layer below them, herbs at bottom and grass at ground level.

FUNCTIONS OF ECOSYSTEM

- All the components of an ecosystem function as an unit with a number of delicately balanced and controlled processes. Plants withdraw biogenetic nutrients from the soil. Their availability is largely dependent upon decomposition and mineralisation of organic detritus. Four important functional aspects of the ecosystem are **productivity, decomposition, energy flow** and **biogeochemical cycles.**

A. PRODUCTIVITY

- The productivity of an ecosystem refers to the rate of production, *i.e.*, the amount of organic matter or biomass accumulated per unit area in any unit time. It is measured as weight ($g/m^2/yr$) or energy ($kcal/m^2/yr$). Productivity is of following types :

Primary Productivity

- The amount of energy accumulated in green plants as biomass or organic matter per unit area over a time period through the process of photosynthesis is known as primary productivity. Primary productivity depends upon light (solar radiations), temperature, water (moisture), nutrients and photosynthetic capacity or efficiency of producers. It is of two sub-types: GPP and NPP.

Gross primary productivity (GPP)

- It is the amount of organic matter synthesised by producers per unit time and per unit area.
- It depends upon photosynthetic efficiency of producers, availability of solar energy as well as inorganic nutrients.

Net primary productivity (NPP)

- It is the amount of organic matter stored by producers per unit time and per unit area.
- It is equal to organic matter synthesised by photosynthesis minus utilisation in respiration and other losses.
- It depends upon gross primary productivity as well as amount of consumption of photosynthates.
- NPP = GPP – R, where R is energy used in respiration.

Secondary Productivity

- This is the rate of resynthesis of organic matter by the consumers.
- It depends upon the loss while transferring energy containing organic matter from the previous trophic level plus the consumption due to respiration and predation.
- It is small and decreases with rise of trophic level.
- It is due to synthesis of organic matter from organic matter.

B. DECOMPOSITION

- It is the physical and chemical breakdown of complex organic remains with the help of organisms called decomposers. In terrestrial ecosystem, upper layer of soil is the main site of decomposition. Organic remains (dead plant parts, animal remains, and excreta, etc.) are also called **detritus**.
- Decomposition completely disposes off the whole detritus and helps in recycling of biogeochemicals and creating space for newer generations of organisms.

Processes Involved in Decomposition

(i) **Fragmentation of detritus :** It involves feeding of detritivores on larger pieces, the smaller fragments are left. Pulverisation occurs and part of the detritus comes out undigested. Due to fragmentation, left over detritus comes to have large surface area.

(ii) **Catabolism :** Decomposers (*e.g.*, bacteria, fungi) excrete digestive enzymes over the detritus. It changes insoluble complex organic substances into simple and soluble organic compounds and inorganic substances.

(iii) **Leaching :** Soluble substances formed during decomposition are subjected to leaching or passage to deeper layers of soil by percolating water.

(iv) **Humification :** Humus is dark coloured amorphous organic matter rich in lignin and cellulose formed by the process of **humification**.

  – It is colloidal in nature and resistant to microbial action. It acts as reservoir of nutrients and helpful in maintenance of soil moisture and aeration. Humus gets decomposed slowly and thus, releases nutrients slowly.

(v) **Mineralisation :** It involves release of both non-minerals and inorganic minerals from organic matter.

  – It is a slow process because of trapping in humus and immobilisation in decomposers. It prevents their washing out or leaching.

- Temperature and soil moisture are the most important climatic factors that regulate decomposition through their effects on the activities of soil microbes. Warm and moist environment favour decomposition whereas low temperature and anaerobiosis inhibit decomposition resulting in build up of organic materials.
- Decomposition is faster when detritus is rich in nitrogen and sugars than when detritus is rich in lignin and chitin.

INTEXT PRACTICE QUESTIONS

1. **Mention any two factors that affect decomposition.**
2. **Define standing crop.**
3. **What is net primary productivity? Give equation how it is denoted.**

C. ENERGY FLOW

- In an ecosystem, energy is transferred in the form of food, and this leads to degradation and loss of major fraction of food energy as heat during the metabolic activities and a very small fraction becomes stored as biomass.
- The flow of energy is governed by two laws of thermodynamics :
  - First law states that energy can be transferred as well as transformed but is neither created nor destroyed.
  - Second law states that every activity involving energy transformation is accompanied by dissipation of energy.
- The source of energy in all ecosystems, except deep hydrothermal ecosystem is solar energy.
- Energy does not remain trapped permanently in any organism. It is either passed on to the higher trophic level or becomes available to detrivores and decomposers after the organism dies.
- Normally, herbivores feed on producers. Part of the food energy is wasted in digestion and assimilation. Some of the assimilated food is broken down to release energy for performing body activities. A very small portion becomes part of the body of herbivore. Herbivores are eaten by primary carnivores, the latter by secondary carnivores and so on. At every step, a lot of energy is wasted.

Flow of Energy in Ecosystem

- Energy flow in an ecosystem is always **unidirectional** or one way, *i.e.*, solar radiations → producers → herbivores → carnivores. It cannot pass in the reverse direction.
- There is decrease in the content and flow of energy with the rise in trophic level. A part of energy captured by producers (gross primary productivity) is used for maintenance (through liberation in respiration) and as food to herbivores. The remaining net productivity is either used by humans or passes into detritus chain.
- A lot of wastage of food occurs during ingestion by herbivores. Energy is used for digestion of food. A part is lost as a faecal matter to decomposers.
- Part of assimilated food is also broken down to release energy in the process of respiration. This energy is lost as heat.
- About 1-5% of incident solar energy or 2-10% of PAR is captured by the photosynthetic organisms in synthesis of organic matter (Gross primary productivity).

The Ten Percent (10%) Law

Raymond Lindeman proposed 10% law in 1992. According to this law, only 10% of the energy available at one trophic level passes to the next trophic level and 90% of energy is lost. Thus, 1000 kcal of biomass energy makes available only 1 kcal of biomass energy at the level of carnivore II and 0.1 kcal of biomass energy at the level of carnivore III. Therefore, for supporting a higher trophic level organism a large amount of biomass is required at the producer level.

The residual energy decreases drastically within 2-3 trophic levels. Therefore, an ecosystem can support only a limited number of trophic levels.

Producers →	Herbivore →	Carnivore →	Top Carnivore II
1000 kcal	100 kcal	10 kcal	1 kcal

- A trophic level is a step or division of food chain which is characterised by the method of obtaining its food. The number of trophic levels is equal to the number of steps in the food chain.

Food Chain

- A food chain involves a nutritive interaction between the living organisms (biotic components) of an ecosystem. In a food chain, there occurs **repeated eating,** *i.e.*, each group eats the other and is subsequently eaten by some other group of organisms.
- A food chain is **always straight** and proceeds in a progressive straight line. The number of steps in a food chain is limited to four or five and at each step, a large portion of the energy is lost as heat. This means that shorter the food chain, the greater will be the biomass that can be supported with a given basic source of potential food energy. Thus, the food chain with fewer number of links or transfers will prove to be the most efficient.
- The basic types of food chains are :
  (i) **Detritus food chain (DFC)** begins with detritus or dead organic matter. Detritivores and decomposers feed over it. Therefore, food energy present in detritus passes into them. Detritivores and decomposers are consumed by smaller carnivores which in turn become food for larger carnivores and so on. A common detritus food chain with earthworm as detritivore is

Detritus → Earthworm → Sparrow → Falcon
↘ Frog → Snake → Peacock

  (ii) **Grazing food chain (GFC)** is the most common food chain. It is also called predator food chain as predation occurs at every step. This food chain consists of producers, consumers and decomposers.

First trophic level	Second trophic level	Third trophic level	Fourth trophic level	Fifth trophic level
Producers →	**Primary consumers →**	**Secondary consumers →**	**Tertiary consumers →**	**Top carnivores**
(Autotrophs) Phytoplanktons (Weeds, diatoms and other green algae)	(Herbivores) Zooplanktons (Dinoflagellates)	(Primary carnivores) Aquatic insects, crustaceans and other aquatic organisms	(Secondary carnivores) Small fish	Large fish

Food Web

- Food web is a network of food chains which become interconnected at various trophic levels so as to form a number of feeding connections amongst the different organisms of a biotic community. Food web is meant for increasing the stability of an ecosystem by providing alternate source of food and allowing the endangered population to grow in size.
- The food webs are very important in maintaining the stability of an ecosystem in nature. For example, decrease in the population of rabbit would naturally cause an increase in the population of alternative herbivore, the mouse. This may decrease the population of the consumer (carnivore) that prefers to eat rabbit. Thus, alternatives serve for maintenance of stability of the ecosystem. Moreover, a balanced ecosystem is essential for the survival of all living organisms of the system.

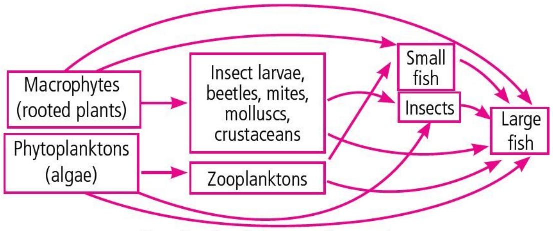

Macrophytes (rooted plants)
Phytoplanktons (algae)
Insect larvae, beetles, mites, molluscs, crustaceans
Zooplanktons
Small fish
Insects
Large fish

Fig.: Food web in a pond ecosystem

- The complexity of any food web depends upon the diversity of organisms in the system. It would accordingly depend upon two main points:
  - Length of the food chain - Diversity in the organisms based upon their food habits would determine the length of food chain. More diverse the organisms in food habits, more longer would be the food chain.
  - Alternatives at different points of consumers in the chain- More the alternatives, more would be the interlocking pattern. In deep oceans, seas, etc., where we find a variety of organisms, the food webs are much complex.

WHO AM I ...

"I am the amount of living biomass or number of living organisms present in an unit area of an ecosystem."

...search me ☺

ELTONIAN (ECOLOGICAL) PYRAMIDS

- An ecological pyramid is a **graphic representation** of the relationship between individuals present in the various trophic levels of a food chain with producers forming the base and top carnivores the tip. Ecological pyramids were developed by **Charles Elton** (1927) and are therefore, also known as **Eltonian pyramids**.
- An ecological pyramid can be **upright**, **inverted** or **spindle shaped**.
- Ecological pyramids are of following three types :

Pyramid of Numbers

- It represents the number of individual organisms per unit area of various trophic levels.
- In grassland ecosystem, pyramid of numbers is always **upright** as the producers, (*i.e.*, grass) are always maximum in number.
- In pond ecosystem, producers (mainly the phytoplanktons) are maximum in number, therefore, the pyramid of numbers is **upright**.
- In forest ecosystem, the pyramid can be either inverted or spindle shaped. Producers are mainly large sized trees which are lesser in number and form the base of the pyramid.
- In parasitic food chain, the pyramids are always inverted. This is due to the fact, that the number of organisms gradually shows an increase, making the pyramid inverted in shape.

Pyramid of Biomass

- Maximum biomass occurs in producers. There is a progressive reduction of biomass found in herbivores, primary carnivores, secondary carnivores, etc. It is found that about 10-20% of the biomass is transferred from lower trophic level to higher trophic level. The rest is consumed in providing energy for giving heat, overcoming entropy and performing various body activities.
- In grassland and forest, there is generally a gradual decrease in biomass of organisms at successive

levels from the producers to the top carnivores. Thus, pyramids are **upright**.

- In a pond, as the producers are small organisms, their biomass is least and this value gradually shows an increase towards the apex of the pyramid, thus, making the pyramid **inverted** in shape.

Pyramid of Energy

- The pyramid of energy always **upright**, as in most of the cases there is always a gradual decrease in the energy content at successive trophic levels from the producers to various consumers.

Limitations of Ecological Pyramids

- Ecological pyramids assume that food chains are simple, although simple food chains do not occur in nature. Instead, food webs are present.
- A single species may operate at two or more trophic levels. Ecological pyramids have no method of accommodating such cases.
- Ecological pyramids have no place for detritivores and decomposers, though they play a vital role in ecosystem.

ECOLOGICAL SUCCESSION

- Biotic or ecological succession is the natural development of a series of biotic communities at the same site, one after the other till a climax community develops which does not change further because it is in perfect harmony with the environment of the area. The change is orderly and sequential. There is a parallel change in the physical environment. Rather, succession occurs because each biotic community changes the environment of the area that suits another biotic community more than itself.
- The first biotic community which develops in a bare area is called **pioneer community**. It shows little diversity.
- The final, stable, self perpetuating biotic community that develops at the end of biotic succession is called **climax community**. It shows maximum diversity and niche specialisation.
- The various biotic communities that develop during biotic succession are called **seral** or **transitional communities**. It is replaced by another subsequent successional community.
- In the successive seral stages, there is a change in the diversity of species of organisms, increase in the number of species and organisms as well as an increase in the total biomass. The present day communities in the world have come to be because of succession that has occurred over millions of years since life started on earth. Actually ,succession and evolution would have been parallel processes at that time.

Types of Ecological Succession

- On the basis of the type of nudity of the area, ecological succession is of two types, primary and secondary.

Primary succession

- It occurs in an area which has been bare from the beginning. Soil is absent at the time of beginning of primary succession. There is no humus in the beginning. Reproductive structures of any previous community are absent. Pioneer community comes from outside. In the beginning, the environment is very hostile. Seral communities are in abundance. Primary succession takes longer time for completion (1000 years or more).

Secondary succession

- It occurs in an area which has been denuded recently. Soil is present in the area where secondary succession begins. Humus is present from the very beginning. Reproductive structures of the previous occupants are present in the area. Pioneer community develops partly from previous occupants and partly from migrants. The environment is favourable from the beginning. Few seral communities are found. Secondary succession takes lesser time for completion (50-200 years).
- Successions are variously designated as xerosere/lithosere (succession on bare rock), hydrosere (succession in water), psammosere (succession on sand).

Hydrosere (Hydrarch)

- Hydrosere is a type of primary succession which refers to the biotic succession in a newly formed pond or lake.
- The stages that occur in hydrosere are : Plankton stage, (*e.g.*, diatoms, green flagellates, etc.), rooted submerged stage (*e.g.*, *Hydrilla*, *Potamogeton*, etc), rooted floating stage (*e.g.*, *Nymphaea*, *Nelumbo*, etc.), free floating stage (*e.g.*, *Lemna*, *Wolffia*, etc.), reed swamp stage (*e.g.*, *Typha*, *Scirpus*, etc.), marsh (sedge) meadow stage (*e.g.*, *Carex*, *Juncus*, etc.), woodland stage (*e.g.*, *Cornus*, *Populus*, etc.) and climax or forest stage (*e.g.*, *Quercus*, *Ulmus*, etc.)

Xerosere (Xerarch)

- Xerosere or lithosere is also a type of primary succession that occurs at places where moisture is present in minimal amount such as dry deserts, bare rocks, etc.
- The stages that occur in xerosere are : Lichen stage; crustose lichen stage, (*e.g.*, *Graphis*, *Rhizocarpon*, etc.) followed by foliose lichen stage (*e.g.*, *Dermatocarpon*, *Parmelia*, etc.), moss stage (*e.g.*, *Tortula*, *Grimmia*, etc.), grasses and herbs stage (*e.g.*, *Cymbopogon*, etc.), shrub stage (*e.g.*, *Zizyphus*, *Rhus*, etc.) and climax or forest stage (*e.g.*, *Shorea*, etc.).

D. BIOGEOCHEMICAL CYCLES

- Biogeochemical cycles or nutrient cycles are cyclic changes, transfer, storage of biogenetic nutrients through various components of ecosystem (biotic and abiotic), so that the nutrients can be used repeatedly.

- Essential elements or inorganic substances, provided by earth and required by organisms for their body building and metabolism, are known as biogeochemicals or biogenetic nutrients.
- Biogeochemical pools are the store houses of biogenetic materials from which the same can be withdrawn for passage into biota.
- There are two stores of nutrients, reservoir pool and cycling pool.
- **Cycling or nutrient pool** is small, fast moving component which is being emptied and filled repeatedly by exchange between organisms and their immediate environment.
- **Reservoir pool** is the large, slow moving and generally non-biological store house of biogenetic nutrients which is not readily available to producers but can augment the cycling pool through slow transformation, *e.g.*, phosphate in rocks. Rate of release from this pool depends upon environmental factors (pH, temperature, soil, etc.). Its function is to meet deficient nutrients, occur due to influx and efflux.

Types of Biogeochemical Cycle

- On the basis of nature, biogeochemical cycles are mainly grouped into three types : gaseous cycle, sedimentary cycle and mixed cycle.

Gaseous cycles of matter

- In this, the material involved in circulation between biotic and abiotic components of biosphere are gases or vapours and the reservoir pool is the atmosphere or hydrosphere. Turnover rate is rapid. *E.g.*, Nitrogen and carbon cycle.

Sedimentary cycles of matter

- In this, the materials involved in circulation are non-gaseous and the reservoir pool is lithosphere. *E.g.*, Sulphur and phosphorus cycle.

Carbon Cycle

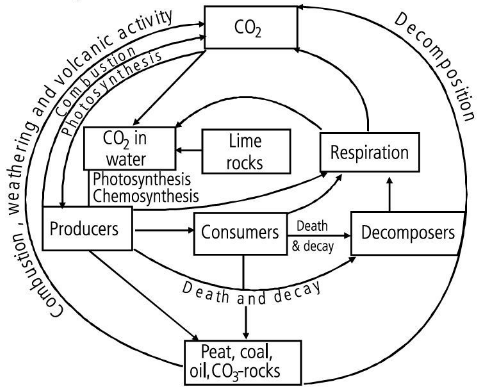

CO$_2$
Combustion, weathering and volcanic activity
Combustion
Photosynthesis
Decomposition
CO$_2$ in water
Lime rocks
Respiration
Photosynthesis
Chemosynthesis
Producers
Consumers
Death & decay
Decomposers
Death and decay
Peat, coal, oil, CO$_3$-rocks

Fig.: Carbon cycle

- The biospheric carbon cycle is primarily concerned with the atmospheric CO$_2$ gas, its incorporation into organic matter by photosynthesis and its subsequent release by the respiration of all biota. Carbon also occurs in the earth's rock predominantly as calcium and magnesium carbonates. The reservoir pool is lithosphere. During photosynthesis, the carbon component of the atmosphere and hydrosphere decreases.
- CO$_2$ can be replenished by various methods like: respiration, decomposition of organic wastes, burning of wood and fossil fuel, weathering of carbonate containing rocks, volcanic eruptions and hot springs.
- Some carbon is being removed from circulation and added to lithosphere by hard carbonaceous shells, animal skeletons, fossilisation, seepage of carbon rich water into interior earth and caving in of forests during earthquakes. Major exchange in carbon cycle is between organisms and the atmosphere or hydrosphere.

Phosphorus Cycle

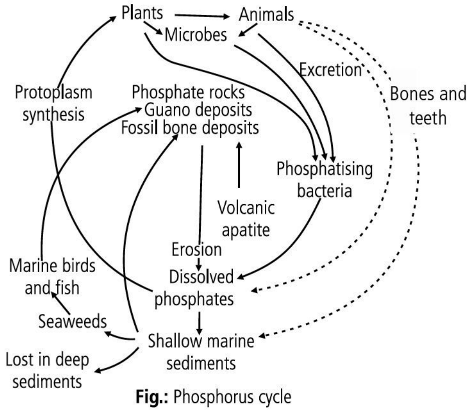

Plants
Animals
Microbes
Excretion
Protoplasm synthesis
Phosphate rocks
Guano deposits
Fossil bone deposits
Bones and teeth
Phosphatising bacteria
Volcanic apatite
Erosion
Marine birds and fish
Dissolved phosphates
Seaweeds
Shallow marine sediments
Lost in deep sediments

Fig.: Phosphorus cycle

- Phosphorus is a major constituent of biological membranes, nucleic acids and cellular energy transfer system.
- It is found in body structures such as bones, teeth, etc.
- Phosphorus is found in nature such as in soil, as rock phosphate, in combination with calcium, iron and aluminium.
- Phosphate circulates in the abiotic environment in lithosphere as well as hydrosphere.
- Phosphate present in the soil may occur in the insoluble form. It is dissolved by chemicals secreted by microorganisms and plant roots. The dissolved phosphate is absorbed by the plants and changed to organic form.
- It travels to animals along with the food chain. On decomposition of animals, it is reutilised by plants.

ECOSYSTEM SERVICES

- Healthy ecosystems are the base for a wide range of **economic, environmental** and **aesthetic goods** and **services**.
- The products of ecosystem processes are named as ecosystem services, for example, healthy forest ecosystems

purify air and water, mitigate droughts and floods, cycle nutrients, generate fertile soils, provide wildlife habitat, maintain biodiversity, pollinate crops, provide storage site for carbon and also provide aesthetic, cultural and spiritual values.

- Though value of such services of biodiversity is difficult to determine, it seems reasonable to think that biodiversity should carry a hefty price tag.
- Robert Costanza and his colleagues have put the value of ecosystem services to 33 trillion dollars. 50% of it is for protection of soil, prevention of floods and mitigating droughts. 10% value is assigned, each for nutrient cycling and recreation and 6% each for climate regulation and habitat for wildlife.

Intext Practice Questions

4. Which stage of succession is represented by *Juncus*?

5. In which form, carbon occurs in earth's rock?

Biodiversity and Conservation

- **Biodiversity** is defined as the occurrence of different types of ecosystems, different species of organisms with the whole range of their variants and genes adapted to different environments along with their processes and interactions.
- The term biodiversity was coined by **W.G. Rosen (1985)** whereas **Edward Wilson (1992)**, a sociobiologist, popularised the term biodiversity.
- According to IUCN (2004), globally total number of known plants and animal species are more than 1.5 million.
- Biodiversity is generated where there are more heterogenecity such as in tropical rainforests and coral reefs.
- India is one of the **12 megadiversity regions** of the world. India shares **8.1%** of total global species diversity.
- India has been divided into ten biogeographical regions (i) Trans Himalayas, (ii) Himalayas, (iii) Desert, (iv) Semi-arid, (v) Western Ghats, (vi) Deccan Peninsula, (vii) Gangetic plain, (viii) North East, (ix) Coasts, (x) Islands.
- The largest biogeographical region is Deccan Peninsula (area 42%) and most biodiversity rich regions are Western Ghats (area 4.0%).
- Total number of known species in India are about 1,42,000 (approximately 45,000 plants and around twice as many of animals).

LEVELS OF BIODIVERSITY

- Diversity helps in producing more productive and stable ecosystems which can tolerate various stresses. Biodiversity has three inter-related hierarchical levels.

(i) **Genetic diversity :** The diversity in the numbers and types of genes as well as chromosomes present in different species and the variations in the genes and their alleles in the same species.

(ii) **Species diversity :** The variety in the number and richness of the species of a region. The number of the species per unit area is called **species richness**. Number of individuals of different species represent **species evenness** or **species equitability**.

(iii) **Ecological diversity :** It is the variety of forms in the ecosystem due to diversity of niches, trophic levels, energy flow, food webs etc.

- Ecological diversity is further classified into three types:
  - **Alpha diversity :** Species diversity within community and habitat depends on species richness and evenness. High tree diversity in rainforest is an example of alpha diversity.
  - **Beta diversity :** Diversity between communities due to replacement of species with change in the habitat. Differences in species composition between a coral reef and the adjoining intertidal zone would be termed as beta diversity.
  - **Gamma diversity :** Diversity in ranges of communities due to diverse habitats or ecosystems over total landscapes. Differences in species composition between coral reef in Gulf of Kutch and in the Andaman Island would be called as gamma diversity.

PATTERNS OF BIODIVERSITY

Latitudinal Gradients

- Barring arid/semiarid and aquatic habitats, biodiversity shows latitudinal and altitudinal gradients.
- Species diversity decreases from the equator towards the poles (from low to high latitudes).

- Tropics, having a latitudinal range of 23.5°N - 23.5°S, are home for more species in comparison to temperate or polar regions.
- Amazon rainforest situated in South America has the maximum biodiversity on earth.
- The reasons for higher tropical diversity are:
  (i) Tropical latitudes have **remained undisturbed** for millions of years allowing species to evolve and flourish unlike temperate areas that have undergone frequent glaciations.
  (ii) **Favourable environment** and relatively constant and predictable climate promoted more niche specialisation and thus, more diversity.
  (iii) Higher productivity due to **more solar energy available** in the tropics is related to greater diversity.
  (iv) Reduced competition due to favourable environment and high resource availability, resulted in more diversity.

Species Area Relationship

- **Alexander von Humboldt** proposed that species richness increases with increasing area but upto a certain limit.
- The relationship between species richness and area turned out to be a **rectangular hyperbola** for wide variety of taxa.
- On a logarithmic scale, the relationship is a straight line described by the equation; $\log S = \log C + Z \log A$

  where, S = Species richness, A = Area, Z = Slope of the line **(regression coefficient)** and C = Y-intercept
- Value of Z is generally in the range of 0.1 to 0.2 irrespective of the taxonomic group or region except for very large areas like continents, where the value of Z is in range of 0.6 – 1.2.

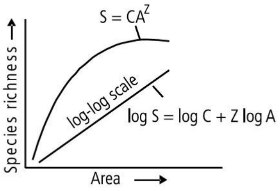


Fig.: Species-area relationship

IMPORTANCE OF BIODIVERSITY TO THE ECOSYSTEM

- The maintenance of biodiversity is important because of the following reasons :
  - Biodiversity is essential for stability of an ecosystem.
  - Biodiversity serves as source of food and provides source material for new improved varieties.
  - Various products of human use can be obtained from rich biodiversity, *e.g.*, gums, resins, dyes, paper, fibres, etc.
  - Various plant species provide different drugs and medicines, *e.g.*, quinine from *Cinchona*, taxol from *Taxus*, etc.
  - Different animal species are used for biological and medical research.
- Importance of species diversity to ecosystem can be explained by various hypothesises such as:
- **Productivity-stability hypothesis :** David Tilman found that areas with more species showed less year to year variation in total biomass. He experimentally showed that, increased diversity contributed to higher productivity.
- **Diversity-stability hypothesis :** According to **Johnson** *et al* 1996, the ecological communities will decrease in ability to recover from disturbances and in productivity if there is reduction in species richness.
- **Rivet popper hypothesis :** According to this hypothesis proposed by Stanford ecologist **Paul Ehrlich** (1981), the relationship between species richness and ecosystem functioning is non-linear, but may follow a variety of possible trajectories. The loss of a few species (or rivets holding together an aeroplane) will initially create no problem, but beyond a certain point losses will cause catastrophic effect.

- Biodiversity in ecosystem provides services without which humans cannot survive. These include soil fertility, pollinators of plants, predators, decomposition of wastes, purification of the air and water, stabilisation and moderation of the climate, decreasing floods, droughts and other environmental disasters.
- **Keystone species** are the crucial species that determine the capacity of large number of species to persist in a community. Protection of keystone species is a priority in conservation efforts, as many important species depend on keystone species for food, reproduction and some other basic needs. Thus, if a keystone species is lost from a conservation area, numerous other species might be lost as well.

Intext Practice Questions

6. How many biogeographical regions are present in India? Name the largest among them.

7. Briefly explain keystone species.

IUCN AND RED DATA BOOK

- **IUCN (International Union of Conservation of Nature and Natural Resources)** is now known as **World Conservation Union (WCU)**. Its headquarters are situated at Gland, Switzerland.
- A **red data book** or **red list** is maintained at WCU which is a catalogue of taxa facing risk of extinction.
- To highlight the legal status of rare species for the purpose of conservation, IUCN has earlier (1963, 84, 88) established the five main conservation categories. These are **extinct, endangered, vulnerable, rare** and **insufficiently known species.**
- Later in 2012, IUCN recognised **9 red list categories** of species.
  - (i) Extinct (Ex) : Taxon has been completely eliminated or died out. *E.g.*, Passenger Pigeon.
  - (ii) Extinct in the Wild (EW) : When no individual is recorded in exhaustive surveys in any of its natural or expected habitats. *E.g.*, Kihansi Spray Toad.
  - (iii) Critically Endangered (CR) : Taxon is facing extremely high risk of extinction in the near future. *E.g.*, Black rhinoceros.
  - (iv) Endangered (EN) : When taxon is not critically endangered, however facing a very high risk of disappearance in the wild in the immediate future. *E.g.*, Dhole.
  - (v) Vulnerable (VU) : Presently the population is sufficient but is undergoing depletion due to some factors so it is facing high risk of extinction in medium term future. *E.g.*, *Latimeria menadoensis.*
  - (vi) Near Threatened (NT) : Evaluated but does not meet the criteria for a threatened category now but is likely to qualify for the same in near future. *E.g.*, *Acacia negrii.*
  - (vii) Least Concern (LC) : Low risk of extinction, *e.g.*, Northwestern salamander.
  - (viii) Data Deficient (DD) : Insufficient information available to make an analysis.
  - (ix) Not Evaluated (NE) : Not evaluated against the criteria.
- The purpose of preparation of red list is to:
  - – Provide awareness to the degree of threat to biodiversity
  - – Provide global index about already declined biodiversity
  - – Identify and document the number of species facing high-risk of extinction
  - – Prepare conservation priorities and help in conservation action

LOSS OF BIODIVERSITY

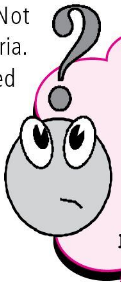
- The most serious aspect of the loss of biodiversity is the **extinction of species**. Extinction is of three types – natural extinction, mass extinction and anthropogenic extinction.
  - (i) **Natural or background extinction** is a slow process of replacement of existing species with the better adapted species due to alternate evolution, changes in environmental conditions, predators and diseases.
  - (ii) Earth has experienced five **mass extinctions** due to environmental catastrophes.
  - (iii) **Anthropogenic extinctions** are extinctions abetted by human activities like settlements, hunting, over exploitation and habitat destruction.

Causes of Biodiversity Losses

- There are four major causes– the **evil quartet :**
  - (i) **Habitat loss and fragmentation** causes serious effects such as microclimatic changes in light, temperature, wind, etc. The most subtle form of habitat degradation is environmental pollution.
  - (ii) Increasing human population has escalated the use of natural resources. Many animals have become extinct in the last 500 years due to **over exploitation** by humans.
  - (iii) Non-native or **alien species** often become invasive and drive away the local species. **Water hyacinth** (*Eichhornia crassipes*) was introduced in Indian waters to reduce pollution. It has clogged water bodies including wetlands at many places resulting in death of several aquatic plants and animals.
  - (iv) Certain obligatory mutualistic relationships exist in nature, *e.g.*, *Pronuba yuccasella* and *Yucca*. Extinction of one will automatically cause extinction of the other. This is known as **co-extinction**.

CONSERVATION OF BIODIVERSITY

- The maintenance of a high level of biodiversity is important for the stability of ecosystems. Thus, there are **three main reasons** to conserve the biological diversity which can be grouped in three categories :



WHO AM I ...

"I am the crucial species that determine the capacity of large number of species to persist in a community"

...search me ☺

(i) **Narrowly utilitarian** (useful human products like food, fibres, drugs and medicine, etc.)

(ii) **Broadly utilitarian** (ecosystem services like provision of pollinators, climate regulation, flood and erosion control, ecological balance through nutrient cycling, etc.)

(iii) **Ethical** (every living species has an intrinsic value though it may not have any direct economic value, and also, every species has a right to live).

Conservation Strategies

- It is of two types :

I. *In-situ* conservation :

- *In situ* (on site) is conservation and protection of the whole ecosystem and its biodiversity at all levels in order to protect the threatened species. Two methods are being used to save biodiversity, hotspots and protected areas.
  - **Hotspots -** Biodiversity **hotspots** are the areas characterised by very high levels of **species richness**, high degree of **endemism** and also accelerated **habitat loss**. Ecologically hotspots are determined by four factors as: number of species/species diversity; degree of endemism; degree of threat to habitat due to its degradation and fragmentation; degree of exploitation.
  - **Protected areas**

(i) **National parks** - These are large areas meant for the protection of flora and fauna and are maintained for scientific, educational and recreational use. They are not usually used for commercial extraction of resources.

(ii) **Sanctuaries -** These are tracts of land with or without lake where wild animals/fauna can take refuge without being hunted.

(iii) **Biosphere reserves** - These are multipurpose protected areas which are meant for preserving genetic diversity in representative ecosystems of various natural biomes and unique biological communities.

UNSCRAMBLE ME

Unscramble the words given in column I and match them with their explanations in column II.

	Column I		Column II
1.	ESOAELGM	(a)	A process where emasculated flowers are covered with bag made of butter paper to prevent contamination of stigma from unwanted pollen.
2.	EERS	(b)	A special membranous structure formed by the infoldings of plasma membrane of prokaryotes.
3.	GOELOCONPS	(c)	Protein secreted by virus-infected cells which prevent further viral infection.
4.	AGBGNIG	(d)	An undifferentiated layer present between the ectoderm and endoderm of animals.
5.	EKSELONTTOYC	(e)	It is the entire sequence of communities that successively change in a given area.
6.	FRENOERTIN	(f)	A central cavity into which the water enters through minute pores in *Sycon*.
7.	LLTEMUCUS	(g)	An elaborate network of filamentous proteinaceous structures present in the cytoplasm of eukaryotic cells.
8.	NGEEMHTAON	(h)	Long, narrow dead cells with thick and lignified cell walls having numerous pits.
9.	NERECLSMAYHC	(i)	It is the term used for the cotyledon of the grass family situated towards lateral side of embryonal axis.
10.	MSEOOSEM	(j)	These are the bacteria commonly found in rumen of cattle and in anaerobic sludge during sewage treatment.

Readers can send their responses at editor@mtg.in or post us with complete address by 10th of every month. Winners' names and answers will be published in next issue.

(iv) **Sacred forests and lakes (= sacred groves)-** These are forest patches around places of worship which are held in high esteem by tribal communities. *E.g.*, Aravalli (Rajasthan), Khasi and Jaintia hill (Meghalaya).

II. *Ex-situ* conservation :

- It is the conservation of threatened plants and animals outside their natural habitats. These include offsite collections and gene banks.
- **Offsite collections** are live collections of wild and domesticated species in botanical gardens, zoological parks, wildlife safari parks, arboreta etc.
- **Gene banks** are institutes that maintain stocks of viable seeds (seed banks), live growing plants (orchards), tissue culture and frozen germplasm (cryopreservation) with the whole range of genetic variability.

International Efforts for Biodiversity Conservation

- Several international treaties and conventions engaged in conservation of biodiversity are as follows:

(i) **Convention on International Trade in Endangered Species (CITES)**

- The convention was signed in 1975 in Washington DC with the aim to put ban on international trade in wildlife. This treaty, till now signed by about 200 countries, lists some 900 species that cannot be commercially treated as live specimens or wildlife product because they are in danger of extinction. CITES has helped reduce international trade in many threatened animals, including elephants, crocodiles and chimpanzees. The Secretariat of the convention is located in Switzerland. India signed the convention and became a party to CITES in 1976.

(ii) **World Conservation Union (WCU)**

The International Union for Conservation of Nature and Natural Resources (IUCN), seeks to influence, encourage and assist societies throughout the world to conserve the diversity of natural resources and their sustainable use (discussed earlier).

(iii) United Nations conference on Environment and Development (UNCED) also called **Earth Summit** at **Rio de Janeiro** (1992), Brazil, promoted Convention on Biological Diversity (CBD) which was signed by 152 nations. Its recommendations came into effect on 29th December 1993. India became a signatory to this Convention on Biological Diversity in May, 1994. A second **World Summit** was held in 2002 in Johannesberg, South Africa. 190 countries attending the Summit pledged to significantly reduce the current rate of biodiversity loss at global, regional and local levels by the year 2010.

Indian Efforts for Conserving Biodiversity

Indian Board of Wildlife (IBWL)

- This is the main advisory body of government of India. It was first constituted in 1952 as an advisory body under the name **Central Board of Wildlife**. Later it was renamed as IBWL.
- A number of Wildlife Acts have been made from time to time by State as well as Union Government for wildlife conservation. Some of these are:

1.	Madras Wild Elephant Preservation Act, 1873.
2.	National Wildlife Action Plan, 1982 endorsed by IBWL.
3.	All India Elephant Preservation Act, 1879.
4.	Forest (Conservation) Act, 1980, amended in 1988.
5.	The Wild Birds and Animals Protection Act, 1912.
6	The Environment (Protection) Act, 1986.
7.	Bengal Rhinoceros Preservation Act, 1932.
8.	The Biodiversity Act, 2002, implemented in 2004.
9.	Assam Rhinoceros Preservation Act, 1954.
10.	The National Environmental Policy, 2006.
11.	Wildlife (Protection) Act, 1972, amended in 1983, 1986, 1991.
12.	Establishment of National Parks, Sanctuaries and Zoological Gardens.

Bombay Natural History Society

- It was founded in 1883; engaged in collection of information and specimens of fauna and flora of India, Burma (Myanmar) and Ceylon.

Wildlife Preservation Society of India, Dehradun

- It was founded in 1958 with several objectives of wildlife management.

INTEXT PRACTICE QUESTIONS

8. Give reasons why there is a need to conserve biodiversity.

9. What do you mean by offsite collection?

☺☺

CBSE warm-up!

Exam on
16th March
2023

CLASS-XII

Practice Paper for CBSE Exams as per the latest pattern and reduced syllabus by CBSE for the academic session 2022-23.

Practice Paper 2022-23

GENERAL INSTRUCTIONS

(i) All questions are compulsory.
(ii) The question paper has five sections and 33 questions. All questions are compulsory.
(iii) Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.
(iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
(v) Wherever necessary, neat and properly labelled diagrams should be drawn.

Time Allowed : 3 hours **Maximum Marks : 70**

SECTION-A

1. In assisted reproductive technology, IVF involves transfer of
(a) ovum into the fallopian tube
(b) zygote into the fallopian tube
(c) zygote into the uterus
(d) embryo with 16 blastomeres into the fallopian tube.

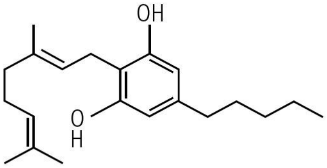
2. Which among the following birth control measures is considered to be highly effective?
(a) Rhythm method
(b) Physical barriers
(c) Contraceptive pills
(d) Sterilisation techniques

3. The age pyramid with broad base indicates
(a) high percentage of old individuals
(b) low percentage of young individuals
(c) a stable population
(d) high percentage of young individuals.

4. An isolated population of humans with approximately equal numbers of blue-eyed and brown-eyed individuals was decimated by an earthquake. Only a few brown-eyed people remained to form the next generation. This kind of change in the gene pool is called
(a) Hardy-Weinberg equilibrium
(b) blocked gene flow
(c) genetic drift
(d) gene migration.

5. Injection of antitoxin in tetanus confers which type of immunisation?
(a) Active immunisation (b) Passive immunisation
(c) Auto-immunisation (d) Humoral immunisation

6. Identify the given diagram and its effect.



(a) Cannabinoid - Hallucination
(b) Morphine - Sedative
(c) Cocaine - Analgesic
(d) Smack - CNS depressant

7. Biogas is produced by (i) breakdown of biomass with the help of (ii) bacteria.

	(i)	(ii)
(a)	anaerobic	*Methanobacterium*
(b)	aerobic	*Rhizobium*
(c)	anaerobic	*Rhizobium*
(d)	aerobic	*Methanococcus*

8. Match the items in column I with their uses in column II and choose the right option.

	Column I		**Column II**
A.	Micro-injection	(i)	Gold coated DNA
B.	PCR	(ii)	Gene amplification
C.	Biolistics	(iii)	Direct introduction of recombinant DNA

(a) A-(iii), B-(ii), C-(i) (b) A-(ii), B-(i), C-(iii)
(c) A-(iii), B-(i), C-(ii) (d) A-(i), B-(ii), C-(iii)

9. In a population of 500 zebras, average natality is 25, average mortality is 20, immigration is 30 and emigration is 35. What will be the population at the end of 10 years?
(a) 550 (b) 600 (c) 650 (d) 500

10. Maximum species diversity is seen in latitudinal range of
(a) 23.5° N to 66.5° N (b) 23.5° N to 23.5° S
(c) 23.5° S to 66.5° N (d) 66.5° N to 90° N.

11. Match the following columns and select the correct option.

	Column I		**Column II**
A.	Leaching	(i)	Catabolism
B.	Degradation of detritus by bacterial and fungal enzymes	(ii)	Break down detritus into smaller particles
C.	Humification	(iii)	Precipitation of soluble inorganic nutrients
D.	Fragmentation	(iv)	Accumulation of dark coloured amorphous substance

(a) A - (iii), B - (ii), C - (iv), D - (i)
(b) A - (iii), B - (i), C - (iv), D - (ii)
(c) A - (i), B - (ii), C - (iv), D - (iii)
(d) A - (iv), B - (iii), C - (ii), D - (i)

12. Which one of these is not included in the biodiversity hotspots of India?
(a) Western Ghats (b) Himalayas
(c) Indo-Burma (d) North Indian Plains

Question No. 13 to 16 consist of two statements – Assertion (A) and Reason (R).

Answer these questions selecting the appropriate option given below:

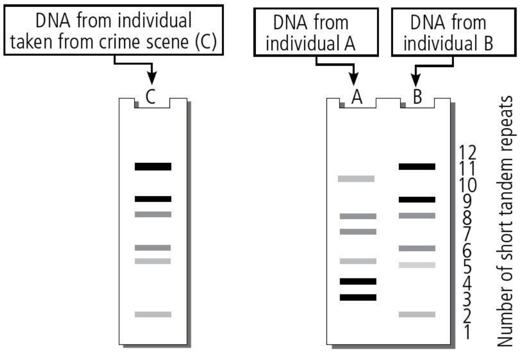
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true and R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

13. Assertion : Ex-albuminous seeds do not possess any residual endosperm, as it is completely consumed during embryo development.
Reason : Wheat, castor, maize and barley are examples of ex-albuminous seeds.

14. Assertion : Linked genes do not show dihybrid ratio of 9 : 3 : 3 : 1.
Reason : Linked genes do not undergo independent assortment.

15. Assertion : Human insulin can be produced into bacterial cells using biotechnology.
Reason : To produce human insulin, A, B and C polypeptides of the human insulin are produced separately in the bacterial cells, extracted and combined by creating disulphide bonds.

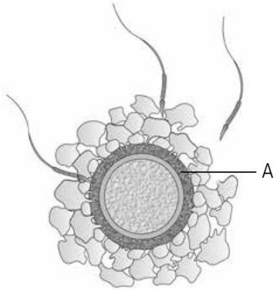
16. Given below is the representation of the DNA fingerprinting depicting the amplified repeats separated by size using gel electrophoresis. Study the given picture and comment upon the appropriateness of the Assertion and Reason.


DNA from individual taken from crime scene (C)
DNA from individual A
DNA from individual B
C
A
B
12
11
10
9
8
7
6
5
4
3
2
1
Number of short tandem repeats

Assertion : The banding pattern of DNA shows that individual B commits the crime.
Reason : The banding pattern of DNA from crime scene (C) matches with individual B rather than A.

SECTION-B

17. Refer to the given figure and answer the following questions:



(a) One of the sperms is observed to penetrate 'A' of the ovum, as shown in the diagram. Name 'A'.
(b) Why only one sperm can penetrate and fertilise the ovum?

18. Give an example of a gene responsible for multiple phenotypic expressions. What are such genes called ? State the cause that is responsible for such an effect.

19. A young boy when brought a pet dog home started to complaint of watery eyes and running nose. The symptoms disappeared when the boy was kept away from the pet.

(a) Name the type of antibody and the chemicals responsible for such a response in the boy.

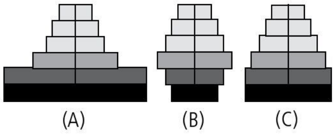
(b) Mention the name of any one drug that could be given to the boy for immediate relief from such a response.

20. Some strains of *Bacillus thuringiensis* produce proteins that kill certain insects. *B. thuringiensis* forms protein crystals during a particular phase of growth.

(a) Explain the mechanism of action of Bt.

(b) Why does the toxin produced not kill the *Bacillus*?

21. Study the age pyramids 'A', 'B' and 'C' of the human population given below and answer the questions that follow:



(a) Identify pyramids 'B' and 'C'.

(b) Write the basis on which the above pyramids are plotted.

OR

(a) What is primary productivity?

(b) Why does the primary productivity vary in different types of ecosystems?

SECTION-C

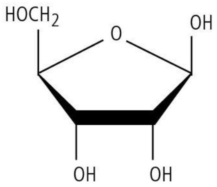
22. Medically it is advised to all young mothers that breast feeding is the best for their newborn babies. Do you agree? Give reasons in support of your answer.

23. **(a)** Name the organic material exine of the pollen grain is made up of. How is this material advantageous to pollen grain?

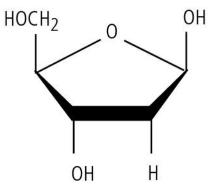
(b) Still it is observed that it does not form a continuous layer around the pollen grain. Give reason.

(c) How are 'pollen banks' useful?

24. Carefully examine structures A and B of pentose sugar given below. Which one of the two is more reactive? Give reasons.



A



B

25. Differentiate between homology and analogy. Give one example of each.

26. "Prevention is better than cure" is an apt slogan to safeguard adolescents from drug abuse. List any six measures that could be taken in this regard.

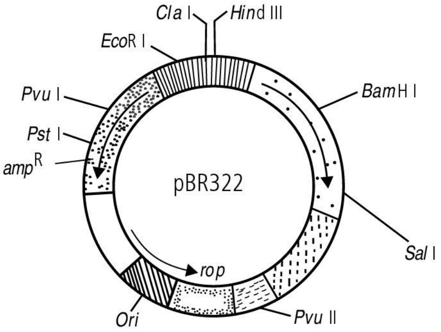
OR

Mention any two human diseases caused by roundworms. Name their causative agents and their mode of transmission into the human body.

27. **(a)** Name the organism in which the vector shown is inserted to get the copies of the desired gene.

(b) Mention the area labelled in the vector responsible for controlling the copy number of the inserted gene.

(c) Name and explain the role of a selectable marker in the vector shown.

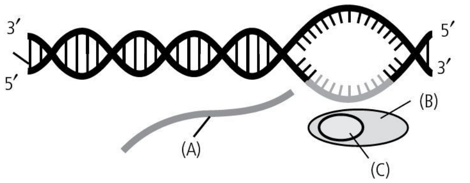


28. How can you measure population density of a habitat?

SECTION-D

Question No. 29 and 30 are case based questions. Each question has subparts with internal choice in one subpart.

29. The process of copying genetic information from template strand of DNA into RNA is called transcription. It is mediated by RNA polymerase. Transcription takes place in the nucleus of eukaryotic cells. In transcription, only a segment of DNA and only one of the strands is copied into RNA. Transcription mainly consists of three steps. One of the steps of transcription is given below.



(a) Identify the given step and name the labels A, B and C.

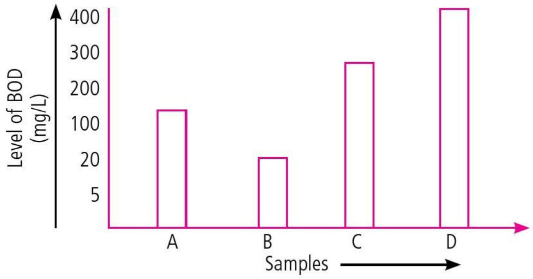
(b) What will happen if C is not available in the above process?

(c) What changes will take place in A after the completion of above process in eukaryotes?

OR

(c) Briefly explain the given step in prokaryotes.

30. BOD is a measure of organic matter present in the water. The data below shows the concentration of BOD in different samples obtained from the primary effluent, secondary effluent, untreated sewage and river water.



(a) With reference to the above graph, identify the source of different samples A, B, C and D.

(b) Which among the given samples will contain large number of pathogenic microbes?

(c) What would happen if D is disposed off in B directly?

OR

(c) What would be the reason for the higher value of BOD in sample D? Name the steps require to lower the BOD of sample D.

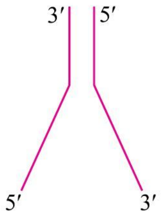
SECTION-E

31. With the help of diagram, explain the development of megaspore mother cell up to the formation of a mature embryo sac in a flowering plant.

OR

Describe the roles of pituitary and ovarian hormones during the menstrual cycle in a human female.

32.



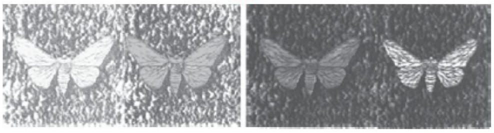
(a) Identify the structure shown above.

(b) Redraw the structure and label the parts.

(c) Write the source of energy for this replication and list the enzymes involved in this process.

(d) Mention the difference in the synthesis based on the polarity of the two template strands.

OR



(i) (ii)

(a) What do these pictures '(i)' and '(ii)' illustrate with reference to evolution? Explain.

(b) How does industrial melanism support Darwin's theory of natural selection? Explain.

33. (a) Prepare a flow chart in formation of recombinant DNA by the action of restriction endonuclease enzyme *Eco*RI.

(b) Name the source of *taq* polymerase. Explain the advantage of its use in biotechnology.

OR

(a) What is biopiracy? Explain its significance with example.

(b) State the initiative taken by Indian Parliament against biopiracy.

SOLUTIONS

1 **(b)**

2. **(d) :** Sterilisation or surgical intervention blocks gamete transfer and thereby prevent conception. This technique is highly effective.

3. **(d)** **4. (c)**

5. **(b) :** If a person is infected with some deadly microbes, a quick immune response is required against microbes. This quick response can be initiated by directly injecting the preformed antibodies or antitoxin. This type of immunisation is called passive immunisation.

6. **(a)**

7. **(a) :** Biogas is a methane rich fuel gas produced by anaerobic breakdown or digestion of biomass with the help of methanogenic bacteria. *e.g., Methanobacterium, Methanococcus.*

8. **(a)**

9. **(d) :** $N_{t+1} = N_t + [B + I] - (D + E)]$
$= 500 + [(25 + 30) - (20 + 35)] = 500 + [55 - 55] = 500$

UNSCRAMBLED WORDS

FEBRUARY 2023

1-g-TYPHLOSOLE
2-c-SPLICING
3-d- ADAPTATION
4-j-EPIGYNOUS
5-h-MELATONIN
6-i-COLOSTRUM
7-b-TEGMEN
8-a-LICHEN
9-e-FUNICLE
10-f-PORIN

Winner : *Kajal Sharma (New Delhi)*

mtG

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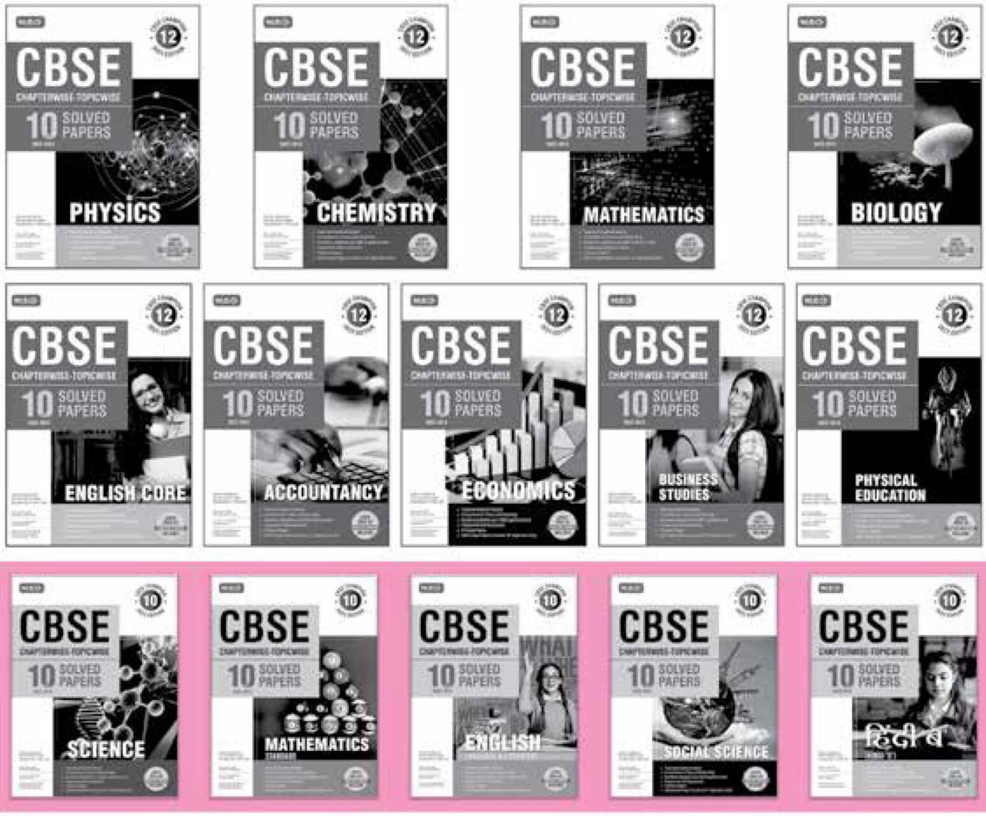
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- Topicwise Graphical Analysis
- Quick Recap with Brain Map
- Previous 10 years (2022-2013) questions of CBSE
- CBSE Cognitive Level Tagging
- Key Points, Answer Tips, Concept Applied, Shortcuts, Alternating Methods, Commonly Made Mistakes provided
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10. (b) : Biodiversity shows latitudinal and altitudinal gradients. There is little biodiversity at the poles. It increases in temperate areas, but reaches the maximum in tropics (23.5° N to 23.5° S). It is because the tropical rainforests have favourable environmental conditions not only for speciation, but also for supporting both variety and number of organisms.

11. (b) **12. (d)**

13. (c) : In some seeds, the endosperm persists in the seed as food storage tissue. Such seeds are called endospermic or albuminous, *e.g.*, castor, maize, wheat, barley, rubber, coconut.

14. (a) : Linked genes are those genes which occurs on the same chromosome. They do not show independent assortment, hence deviates from the dihybrid ratio of 9 : 3 : 3 : 1.

15. (c) **16. (a)**

17. (a) A is zona pellucida.

(b) During fertilisation, a sperm comes in contact with the zona pellucida layer of ovum which induces changes in the egg membrane that block the entry of additional sperms. So, zona pellucida ensures that only one sperm can fertilise an ovum.

18. Gene causing phenylketonuria causes multiple phenotypic expressions. Such genes are called pleiotropic genes. This effect of multiple phenotypic expressions is caused due to single gene mutation.

19. (a) Such a response in the boy is called allergy which occurs due to production of IgE antibodies and chemicals like histamine and serotonin from the mast cells.

(b) Anti-histamine could be given to the boy for immediate relief from such a response.

20. (a) When an insect ingests the crystals, it is converted into an active form of toxin due to the alkaline pH of its alimentary canal that solubilises the crystals. The activated toxin binds to the surface of midgut epithelial cells and create pores that cause cell swelling, lysis and eventually cause death of insect.

(b) The toxin does not kill the bacteria because it exists as inactive protoxins in them.

21. (a) The given pyramids 'B' and 'C' represent urn-shaped age pyramid with declining population and bell-shaped age pyramid with stable population respectively.

(b) The graphical representation called age-pyramids are plotted on the basis of individuals present in a population under the categories : number of individuals of pre-reproductive age at the base, reproductive in the middle and post-reproductive age at the top.

OR

(a) Primary productivity is the amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis. It is expressed in terms of gm^{-2} yr^{-1} or (kcal m^{-2})yr^{-1}.

(b) Primary productivity varies in different types of ecosystems, because it depends upon plant species of the area, their photosynthetic capacity, availability of nutrients, solar radiations, precipitation, soil type and other environmental factors.

22. Yes, I agree that all young mothers must breast-feed their newborn babies to provide best nourishment to them. Human milk consists of fat, casein (milk protein), lactose (milk sugar), mineral salts (sodium, calcium, potassium, phosphorus, etc). and vitamins that are necessary for development of the child. The milk produced during the initial few days of lactation is colostrum which contains several antibodies (IgA). This milk helps in developing resistance to disease in newborn babies.

23. (a) Exine is made up of a highly resistant fatty substance called sporopollenin. Sporopollenin is highly protective layer which cannot be degraded by any enzyme. It is not affected by high temperature, strong acid or strong alkali. Because of sporopollenin, exine provides protection during the hazardous journey of pollen from anther to stigma. Also, pollen grains are well preserved as microfossils and protected from external adversities due to the presence of sporopollenin.

(b) Exine of pollen grain is not a continuous layer. It bears prominent apertures called germ pores. These are the places from where intine comes out as pollen tube, which carries male gametes required for fertilisation in angiosperms. If the exine is present as a continuous layer, it would render the pollen grain non-functional.

(c) Pollen banks are used to store pollen grains for long time, which can be used in plant breeding programmes. In pollen banks, pollens are stored in liquid nitrogen at a temperature of –196°C.

MONTHLY TEST DRIVE CLASS XII ANSWER KEY

1.	(a)	**2.**	(a)	**3.**	(a)	**4.**	(d)	**5.**	(a)
6.	(b)	**7.**	(b)	**8.**	(d)	**9.**	(b)	**10.**	(a)
11.	(a)	**12.**	(c)	**13.**	(d)	**14.**	(a)	**15.**	(d)
16.	(a)	**17.**	(b)	**18.**	(b)	**19.**	(a)	**20.**	(b)
21.	(d)	**22.**	(a)	**23.**	(a)	**24.**	(b)	**25.**	(d)
26.	(d)	**27.**	(a)	**28.**	(a)	**29.**	(a)	**30.**	(c)
31.	(a)	**32.**	(c)	**33.**	(a)	**34.**	(b)	**35.**	(b)
36.	(a)	**37.**	(a)	**38.**	(b)	**39.**	(b)	**40.**	(b)

24. In the given structures A represents ribose sugar and B represents deoxyribose sugar.

Ribose sugar (A) is more reactive than deoxyribose sugar (B) as 2′–OH group present in the ribose sugar makes it more labile and easily degradable. DNA has evolved from RNA with chemical modification that makes it more stable. DNA being double stranded and having complementary strand further resists changes.

25. The differences between homology and analogy are as follows :

	Homology	**Analogy**
(i)	It is the similarity between organs of different animals based on common ancestry or common embryonic origin and built on same fundamental pattern, but perform varied functions and have different appearance.	It is almost similar appearance of organs performing similar function, but develop in totally different groups and have totally different basic structure and developmental origin.
(ii)	It illustrates divergent evolution.	It illustrates convergent evolution.
(iii)	*E.g.*, Thorns of *Bougainvillea* and tendrils of *Cucurbita*.	*E.g.*, Sweet potato and potato.

26. Yes, it is always better to prevent the adolescents from being getting addicted to harmful drugs, rather than cure them for addiction. Measures that could be taken in this regard are:

(i) A child should not be pushed unduly to perform beyond his/her threshold limits in studies, sports or any other activities.

(ii) Educating and counselling him/her to face problems and stresses and accept disappointments and failures as part of life.

(iii) Parents and teachers can identify the danger signs and take appropriate steps to diagnose the malady and underlying causes, so that proper remedial steps can be taken.

(iv) Help should be taken from qualified psychologists and psychiatrists.

(v) The individual can seek help from parents and teachers.

(vi) Help can also be taken from close and trusted friends; this would help to vent the feelings, anxiety and guilt.

OR

Two human diseases caused by roundworms are :

(i) Ascariasis - It is caused by *Ascaris lumbricoides* and spreads through contaminated fruits, water, vegetables, etc.

(ii) Filariasis - It is caused by *Wuchereria bancrofti* and *W. malayi*. It is transmitted through the bite of female *Culex* mosquito.

27. (a) The vector shown is inserted into *Escherichia coli* to get the copies of the desired gene.

(b) Origin of replication (*ori*) is a sequence from where replication starts and is also responsible for controlling the copy number of the linked DNA.

(c) The sequence *amp*^{R} and *tet*^{R} are considered useful selectable markers. The given vector shows *amp*^{R} selectable marker. Vector requires a selectable marker, because it helps in identifying and eliminating non-transformants and selectively permitting the growth of the transformants.

28. Population density means number of individuals present per unit area or per unit volume of the environment in which the population exists. We can find out population density of a habitat by determining the population size.

The different methods to study population size are as follows:

(i) Quadrat method : It is a method which involves the use of square of particular dimension to measure number of organisms. For example, the number of *Parthenium* plants in a given area can be measured using the quadrat method.

(ii) Direct observation: It involves counting of organisms. For example, in order to determine the number of bacteria growing in a petri dish, their colonies are counted.

(iii) Indirect method : The number of fishes caught per trap gives the measure of their total density in a given water body.

29. (a) The given figure represents the termination process during transcription in bacteria. A is *m*RNA transcript, B is RNA polymerase and C is Rho factor.

(b) When RNA polymerase reaches to termination region, rho factor finds it and alters its specificity. As a result, the process of transcription terminates if Rho factor is absent and termination will not occur.

(c) After the completion of transcription in eukaryotes, the newly formed RNA undergoes three processes namely, capping, tailing and splicing.

OR

(c) A short stretch of RNA remains bound to the enzyme. RNA polymerase associates transiently with termination factor (ρ) to terminate the transcription. RNA synthesis stops as soon as polymerase reaches the terminator region, the nascent RNA falls off, so also the RNA polymerase.

30. (a) A - Secondary effluent, B - River water
C - Primary effluent, D - Untreated sewage water

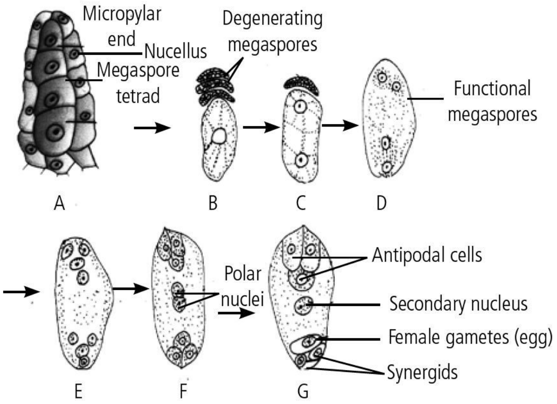
(b) Untreated sewage water (D) contains large amount of microbes, which are pathogenic.

(c) If sample D *i.e.*, untreated sewage water is disposed off in a freshwater body (a river) *i.e.*, sample B then BOD in B will increase and dissolved oxygen will decrease.

OR

(c) High value of BOD in sample D is due to high amount of organic wastes and aerobic microbes present in it. Sample D requires physical removal of particles from the sewage through filtration and sedimentation.

31. In an ovule, a large cell containing dense cytoplasm and prominent nucleus in micropylar region functions as megaspore mother cell (MMC). The MMC undergoes meiosis and produce four haploid megaspores. One of the megaspore remains functional while other three degenerate. The functional megaspore is the first cell of female gametophyte. The nucleus of megaspore divides by mitosis into eight daughter nuclei. Out of eight nuclei two polar nuclei remains in centre. Three nuclei move towards base of embryo sac and the remaining three nuclei at the micropylar end. After eight nucleate stage, cell walls are laid down leading to the organisation of typical embryo sac of female gametophyte. Different stages in the formation of embryo sac from functional megaspore are represented diagrammatically as follows :



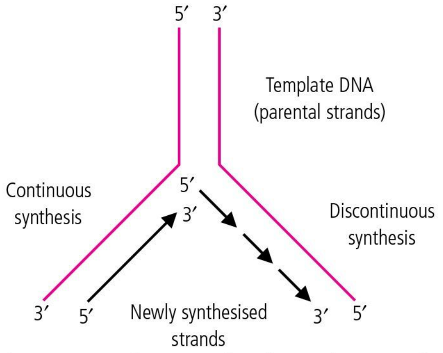
OR

Menstrual cycle in a human female consists of menstrual phase, proliferative phase (follicular phase), ovulatory phase and secretory phase (luteal phase). Days 1-5 of the cycle are known as the menstrual phase. During this phase, menstruation occurs. At the beginning of this stage, levels of progesterone and estrogen have dropped dramatically because of the degeneration of the last cycle's corpus luteum. This triggers the shedding of endometrium. The detached portion of the endometrium as well as blood will pass through the vagina as the menstrual flow. Days 6-14 are known as the proliferative phase. Proliferative phase consists of growth of endometrium of uterus, fallopian tube and vagina. In ovary, a Graafian follicle grows, matures and secretes estrogen during this phase. The endometrium grows thicker and becomes more vascularised and glandular. Change in the levels of pituitary and ovarian hormones bring about these changes in the ovary and uterus. The levels of LH and FSH increase gradually during the follicular phase and stimulate follicular development as well as secretion of estrogens by the growing follicles. In ovulatory phase, both LH and FSH attain a peak level in the middle of cycle (about 14th day). Rapid secretion of LH leading to its maximum level during the mid-cycle called LH surge induces rupture of Graafian follicle and thereby the release of ovum (ovulation).

After ovulation and in response to luteinising hormone, the portion of the Graafian follicle that remains in the ovary enlarges and is transformed into a corpus luteum containing yellow substance (called lutein) and the luteal phase begins. The corpus luteum secretes large amount of progesterone which is essential for maintenance of endometrium. Such an endometrium is necessary for implantation of the fertilised ovum and other events of pregnancy. In the absence of fertilisation, the corpus luteum degenerates. This causes disintegration of the endometrium leading to menstruation, marking a new cycle.

32. (a) Given structure represents replicating fork. The two parental strands of DNA unwind at the start of replication.

(b)



(c) The sources of energy for the replication of DNA are phosphorylated nucleotides or deoxyribonucleoside triphosphates *i.e.*, dATP, dCTP, dGTP and dTTP.

Various enzymes required during DNA replication are helicase, phosphorylase, topoisomerase, DNA polymerase I, II and III, primase and DNA ligase.

(i) Helicase : It acts over the *ori* site and unwinds the two strands of DNA.

(ii) Phosphorylase : It is required for phosphorylation of deoxyribonucleotides.

(iii) Topoisomerase : It helps in nicking of one strand of DNA to release tension.

(iv) DNA polymerase I : It is a major repair enzyme and it has 5′ ⟶ 3′ exonuclease activity.

(v) DNA polymerase II : It is a minor repair enzyme.

(vi) DNA polymerase III : It involves addition and polymerisation of new bases.

(vii) Primase : It helps in formation of RNA primer.

(viii) DNA ligase : Okazaki fragments are joined by DNA ligase.

(d) DNA polymerase can polymerise nucleotides only in 5′ ⟶ 3′ direction because it adds them at the 3′ end. Since the two strands of DNA run in antiparallel directions, the two templates provide different ends for replication. Replication over the two templates thus, proceeds in opposite direction. One strand with polarity 3′ ⟶ 5′ forms its complementary strand continuously because 3′ end of the latter is always open for elongation. It is called leading strand. Replication is dicontinuous on the other template with polarity 5′ ⟶ 3′ because only a short segment of DNA strand can be built in 5′ ⟶ 3′ direction due to exposure of a small stretch of template at one time.

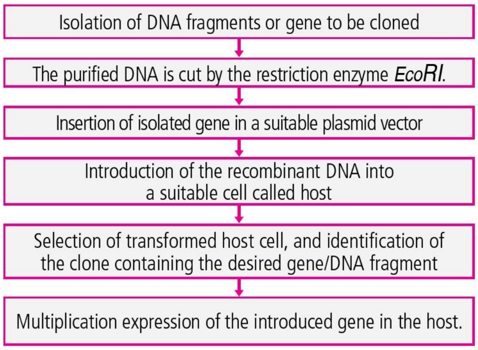
OR

(a) In picture '(i)' the light-coloured species is well adapted to the lighter background of the lichen covered trunks of trees.Here it is not seen by the predatory birds. In contrast, the dark winged moths are quite visible against the lighter background hence, are spotted and picked by the predatory birds. In the industrial areas, as in picture '(ii)' sulphur dioxide pollution from the burning of coal killed the lichens growing on the trees, exposing the darker bark, which was further darkened by the falling smoke particles. Against a dark background, the light-coloured moths are conspicuous and are picked up by the predatory birds. For the survival, nature has favoured the dark-coloured melanic species from the light-coloured species. The former has a much better chance of survival under the new conditions created by pollution.

(b) Natural selection is the process by which those organisms that are best suited to their environment and are able to reproduce well in changed environmental conditions and survived. One of the most striking examples, which demonstrates the action of natural selection in the wild is the case of peppered moth, *Biston betularia* that lives in all parts of England.

Due to industrial smoke and soot, the pale tree trunks became more and more blackened. As a result, the light moths stood out in contrast to its background, increasing the possibility of being easily detected and eaten by their predators, such as birds, in much greater number than the dark melanic variety. Decrease in the number of light winged moths and increase in the number of dark variety was the ultimate result. Therefore, evolution favoured the dark winged melanic moths to reproduce more successfully for their adaptation in the polluted areas of England. Evolution of darker form in response to industrial pollution is known as industrial melanism.

33. (a)



Isolation of DNA fragments or gene to be cloned

The purified DNA is cut by the restriction enzyme *EcoRI*.

Insertion of isolated gene in a suitable plasmid vector

Introduction of the recombinant DNA into a suitable cell called host

Selection of transformed host cell, and identification of the clone containing the desired gene/DNA fragment

Multiplication expression of the introduced gene in the host.

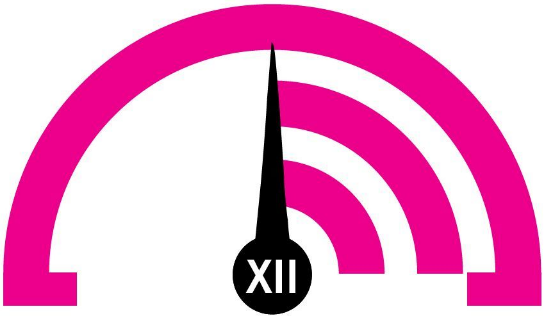
(b) *Taq* polymerase is a thermostable DNA polymerase isolated from thermophilic bacterium *Thermus aquaticus*. *Taq* polymerase is heat stable enzyme and is able to withstand high temperature induces denaturation of DNA during PCR hence, it is preferred in PCR reactions. It is used to synthesise the segment of DNA between the primers (extension) in polymerase chain reaction at high temperature.

OR

(a) Some organisations and multinational companies exploit and/or patent biological resources or bioresources of other nations without proper authorisation from the countries concerned, this is called biopiracy. Institutions and companies of industrialised nations are collecting and exploiting the bioresources, as follows : (i) They are collecting and patenting the genetic resources themselves. For example, a patent granted in USA covers the entire 'basmati' rice germplasm indigenous to our country. (ii) The bioresources are being analysed for identification of valuable biomolecules. A biomolecule is a compound produced by a living organism. The biomolecules are then patented and used for commercial activities. (iii) Useful genes are isolated from the bioresources and patented. These genes are then used to generate commercial products. (iv) The traditional knowledge related to bioresources is utilised to achieve the above objectives. In some cases, the traditional knowledge itself may be the subject of a patent.

(b) The Indian Parliament has recently cleared the second amendment of the Indian Patents Bill, that takes such issues into consideration, including patent terms emergency provisions and research and development initiative.

MONTHLY TEST DRIVE



This specially designed column enables students to self analyse their extent of understanding of complete syllabus. Give yourself four marks for correct answer and deduct one mark for wrong answer. Self check table given at the end will help you to check your readiness.

Total Marks : 160

Complete Syllabus

Time : 40 Min.

1. Match column I with column II and select the correct answer from the given codes.

Column I	Column II
(A) Monoecious	(i) Date palm
(B) Dioecious	(ii) Cockroach
(C) Bisexual	(iii) Earthworm
(D) Unisexual	(iv) Cucurbits

	A	B	C	D
(a)	(iv)	(i)	(iii)	(ii)
(b)	(i)	(iv)	(ii)	(iii)
(c)	(iv)	(i)	(ii)	(iii)
(d)	(i)	(iv)	(iii)	(ii)

2. Jawless fish had evolved around _______ mya.

(a) 350 (b) 320 (c) 500 (d) 200

3. Given below are four statements regarding the pollination. Identify the incorrect statements.

(i) Autogamy is transfer of pollen grains from the anther to the stigma of another flower of the same plant.

(ii) Xenogamy is transfer of pollen grains from anther to stigma of different plants.

(iii) Geitonogamy is transfer of pollen grains from anther to the stigma of same flower of the same plant.

(iv) Geitonogamy is functionally cross-pollination but genetically similar to autogamy.

Choose answer from the options given below.

(a) (i) and (iii) (b) (i) and (iv)
(c) (ii) and (iv) (d) (i) and (ii)

4. Read the given statements and select the correct option.

Statement I: The pyramid of biomass is always upright, can never be inverted.

Statement II: The pyramid of energy is generally inverted.

(a) Both statements I and II are correct.
(b) Statement I is correct but statement II is incorrect.
(c) Statement I is incorrect but statement II is correct.
(d) Both statements I and II are incorrect.

5. With respect to the female reproductive system, identify the correct statements.

(i) Ovaries are the primary female sex organs that produce the ovum and steroid hormones.

(ii) The ovaries are located one on each side of the upper abdomen.

(iii) Each ovary is covered by thick epithelium which encloses the ovarian stroma.

(iv) The fallopian tubes, uterus and vagina constitute the female accessory ducts.

(v) Fimbriae helps in collection of the ovum after ovulation.

(a) (i), (iv) and (v) (b) (i), (iii) and (v)
(c) (ii), (iv) and (v) (d) (i), (ii) and (iii)

6. How primary endosperm nucleus (PEN) is formed?

(a) When one of the male gametes fuses with nucleus of the egg cell.
(b) When one of the male gametes fuses with two polar nuclei located in the central cell.
(c) When one of the male gametes fuses with the one polar nuclei located in the central cell.
(d) When two male gametes fuses with one polar nuclei located in the central cell.

7. Match the following columns and select the correct option.

Column I	Column II
A. Natality	(i) Number of deaths in the population during a given period of time.
B. Mortality	(ii) Number of births in the population during a given period of time.
C. Immigration	(iii) Number of individuals of the population who left the habitat and gone elsewhere.
D. Emigration	(iv) Number of individuals that have come into the habitat from elsewhere.

	A	B	C	D
(a)	(i)	(ii)	(iii)	(iv)
(b)	(ii)	(i)	(iv)	(iii)
(c)	(i)	(ii)	(iv)	(iii)
(d)	(ii)	(i)	(iii)	(iv)

8. Identify the incorrect statement regarding sexually transmitted infections (STIs).
(a) One must avoid sex with unknown partners.
(b) One should always use condoms during coitus.
(c) Incidence of STIs are high among persons in age group of 15-24 years.
(d) STIs are not a major threat to healthy society.

9. Read the given statements and select the correct option.

Statement I : Turner's syndrome occurs due to the presence of an additional copy of X-chromosome leading into a karyotype of 47, XXY.

Statement II : Klinefelter's syndrome occurs due absence of one of the X chromosomes leading into a karyotype of 45, XO.

(a) Both statements I and II are correct.
(b) Both statements I and II are incorrect.
(c) Statement I is correct and statement II is incorrect.
(d) Statement I is incorrect but statement II is correct.

10. Read the given statements and select the correct option.

Statement I : Totipotency is the capacity to generate the whole new plant from any cell.

Statement II : Micropropagation is a method of production of thousands of plants through tissue culture technique.

(a) Both statements I and II are correct.
(b) Statement I is correct but statement II is incorrect.
(c) Statement I is incorrect but statement II is correct.
(d) Both statements I and II are incorrect.

11. Read the following statements and identify them as true (T) or false (F).
(i) Biomagnification occurs in aquatic food chain.
(ii) Biomagnification is the natural aging of lake by nutrient enrichment of its water.
(iii) Eutrophication refers to increase in concentration of toxicant at successive trophic levels.
(iv) Eutrophication is well known for mercury and DDT.

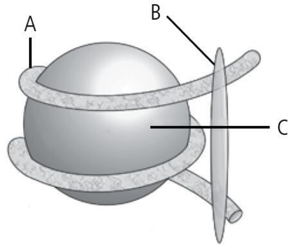
	(i)	**(ii)**	**(iii)**	**(iv)**
(a)	T	F	F	F
(b)	F	T	T	F
(c)	F	T	T	F
(d)	T	T	F	F

12. What would be the fraction of phenotypically recombinant progenies formed when plant RrYy is self crossed?
(a) 9/16 (b) 3/16 (c) 6/16 (d) 1/16

13. Consider the following statements regarding the salient features of the double helix structure of DNA.
(i) It is made of one polynucleotide chain, where the backbone is constituted by sugar-phosphate and the bases project inside.
(ii) The polynucleotide chains have anti-parallel polarity.
(iii) The polynucleotide chains are coiled in a right-handed fashion.
(iv) The pitch of the helix is 3.4 nm and each turn has 10 bp.

Of the above statements
(a) only (i) and (ii) are correct
(b) only (i) and (iv) are correct
(c) only (i) and (iii) are correct
(d) only (ii), (iii), and (iv) are correct.

14. Identify A, B and C in the given figure and select the correct option.



	A	B	C
(a)	DNA	H1 histone	Histone octamer
(b)	DNA	Histone octamer	H1 histone
(c)	H1 histone	DNA	Histone octamer
(d)	Histone octamer	DNA	H1 histone

15. In Meselson and Stahl's experiment, DNA was separated by
(a) paper chromatography
(b) agarose gel electrophoresis
(c) flow cytometry
(d) density gradient centrifugation.

16. Read the given statements and select the correct option.

Statement I : Eye of the octopus and of mammals are example of analogy.

Statement II : Analogous organs are anatomically dissimilar but perform similar functions.

WHO AM I ...

1.	Cardiac Output	Pg. 35
2.	Atrial Natriuretic Factor (ANF)	Pg. 38
3.	Standing crop	Pg. 73
4.	Keystone species	Pg. 78

(a) Both statements I and II are correct.
(b) Statement I is correct but statement II is incorrect.
(c) Statement I is incorrect but statement II is correct.
(d) Both statements I and II are incorrect.

17. "Chromosomal theory of inheritance" was proposed by
(a) Morgan
(b) Sutton and Boveri
(c) Mendel
(d) Watson.

18. *Saccharomyces cerevisiae* is used for commercial production of
(a) statins (b) ethanol
(c) chloride (d) acetic acid.

19. Match column I with column II and select the correct option from the codes given below.

	Column I		Column II
A.	Typhoid	(i)	*Plasmodium vivax*
B.	Common cold	(ii)	*Streptococcus pneumoniae*
C.	Pneumonia	(iii)	Rhino viruses
D.	Malaria	(iv)	*Salmonella typhi*

	A	B	C	D
(a)	(iv)	(iii)	(ii)	(i)
(b)	(i)	(ii)	(iii)	(iv)
(c)	(ii)	(i)	(iii)	(iv)
(d)	(i)	(ii)	(iv)	(iii)

20. Hydrarch succession takes place in __A__ areas and the successional series progress from __B__ to the mesic conditions.

	A	B
(a)	dry	xeric
(b)	wet	hydric
(c)	wet	xeric
(d)	dry	hydric

21. Which one of the following is cytokine barrier of innate immunity?
(a) Skin (b) Saliva in mouth
(c) Tear from eyes (d) Interferons

22. Select the correct statement regarding the crop varieties.
(a) Himgiri is resistant to hill bunt.
(b) Pusa shubhra is resistant to chilly mosaic virus.
(c) Pusa komal is resistant to white rust.
(d) Pusa swarnim is resistant to bacterial blight.

23. Match column I with column II and select the correct option from the codes given below.

	Column I		Column II
A.	Haemophilia	(i)	Autosomal recessive
B.	Sickle-cell anaemia	(ii)	Sex -linked recessive
C.	Colour blindness		
D.	Phenylketonuria		

	A	B	C	D
(a)	(ii)	(i)	(ii)	(i)
(b)	(i)	(i)	(ii)	(i)
(c)	(ii)	(ii)	(ii)	(i)
(d)	(ii)	(i)	(i)	(i)

24. *Ramapithecus* was more __A__ like while *Dryopithecus* was more __B__ like.
(a) A-ape, B- man (b) A-man, B- ape
(c) A-birds, B- reptile (d) A- lizard, B- bird

25. Which of the following statement(s) is/are false?
(i) Lactic acid bacteria grow in milk and convert it into curd.
(ii) The large holes in Swiss cheese are due to production of large amount of CO_2.
(iii) Bacteria responsible for large holes in Swiss cheese is *Propionibacterium shermanii*.
(iv) The "Roquefort cheese" are ripened by growing a specific fungus on them, which gives them particular flavour.
(a) (i), (ii) and (iii) only (b) (ii) and (iii) only
(c) (iii) and (iv) only (d) None of these

26. Choose the incorrectly matched pair.
(a) *Hind* II - First identified restriction endonuclease
(b) *rop* - Replication of plasmid
(c) Exonuclease - Remove nucleotides from the ends of the DNA
(d) Ligase - Breakdown the two DNA molecules

27. When plant cells are bombarded with high velocity micro-particles of tungsten coated with DNA, this method known as
(a) biolistics
(b) micro-injection
(c) insertional inactivation
(d) micropropagation.

28. DNA fragments are separated by the technique known as
(a) gel electrophoresis
(b) ELISA
(c) recombinant DNA technology
(d) polymerase chain reaction.

29. Who is the father of ecology in India?
(a) Ramdeo Misra (b) A.G Tansley
(c) Herbert Boyer (d) Ernst Haeckel

Motivational Quote

Our world is built on biology and once we begin to understand it, it then becomes a technology.

– Ryan Bethencourt

30. What is the function of Sertoli cells?
(a) It undergo meiotic division to produce sperms.
(b) It undergo meiotic division to produce eggs.
(c) It provide nutrition to the germ cells.
(d) It maintains the low temperature in scrotum.

31. Some snails and fish go into aestivation to avoid
(a) summer related problems
(b) winter related problems
(c) spring related problems
(d) osmotic problems.

32. Identify the type of population interaction on the basis of following examples.
I. Orchid growing on mango branch
II. Sea anemone and clown fish
III. Cattle egret and grazing cattle
IV. Barnacles growing on the back of whale
(a) Competition (b) Parasitism
(c) Commensalism (d) Amensalism

33. The secondary lymphoid organs are
(a) spleen, lymph nodes and tonsils
(b) bone marrow and thymus
(c) Peyer's patches of small intestine and thymus
(d) bone marrow and appendix.

34. Stratification is a
(a) horizontal distribution of different species occupying different levels
(b) vertical distribution of different species occupying different levels
(c) vertical distribution of different species occupying same levels
(d) vertical distribution of same species occupying different levels.

35. A fruit which develop from any other part of the flower other than ovary is known as_________.
(a) true fruit (b) false fruit
(c) parthenocarpic fruit (d) non-seasonal fruit

36. Endemic species are
(a) confined to a particular region and not found anywhere else
(b) found in different geographical regions
(c) found in urban area
(d) those species which need not to be conserved.

37. Read the following statements and identify them as true (T) or false (F).
(i) Detritivores break down detritus into smaller particles.
(ii) Catabolism is degradation of detritus into simpler inorganic substances by bacterial and fungal enzymes.
(iii) Humification leads to accumulation of a dark coloured amorphous substance called humus.
(iv) The humus is degraded by some microbes and inorganic nutrients are released by the process known as mineralisation.

	(i)	**(ii)**	**(iii)**	**(iv)**
(a)	T	T	T	T
(b)	T	T	T	F
(c)	T	T	F	F
(d)	F	T	T	T

38. Clone is
(a) morphologically and genetically dissimilar individuals
(b) morphologically and genetically similar individuals
(c) morphologically similar and genetically dissimilar individuals
(d) morphologically dissimilar and genetically similar individuals.

39. Read the given contrasting traits studied by Mendel in pea and select the incorrect ones.

	Characters	**Contrasting traits (Dominant/Recessive)**
(i)	Stem height	Tall/dwarf
(ii)	Flower colour	Violet/white
(iii)	Flower position	Axial/terminal
(iv)	Pod shape	Inflated/constricted
(v)	Seed colour	Green/yellow
(vi)	Seed shape	Round/wrinkled
(vii)	Pod colour	Yellow/green

(a) (i), (iii) and (iv) (b) (v) and (vii)
(c) (ii), (vi) and (vii) (d) (iv) and (v)

40. Calculate the available biomass for the consumption to heterotrophs if the rate of production of organic matter during photosynthesis is 100 gm^{-2} yr^{-1} and respiration loses is 50 gm^{-2} yr^{-1}.
(a) 100 gm^{-2} yr^{-1} (b) 50 gm^{-2} yr^{-1}
(c) 150 gm^{-2} yr^{-1} (d) 0 gm^{-2} yr^{-1}

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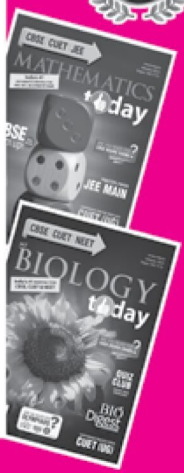

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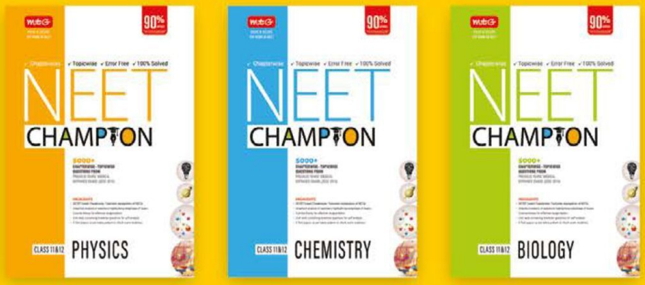

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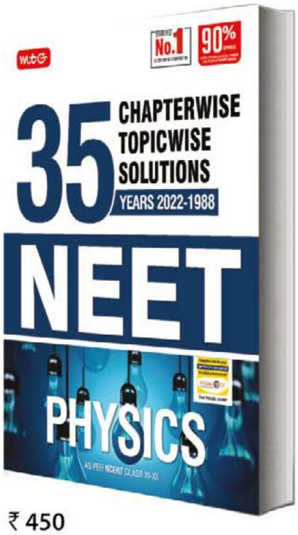
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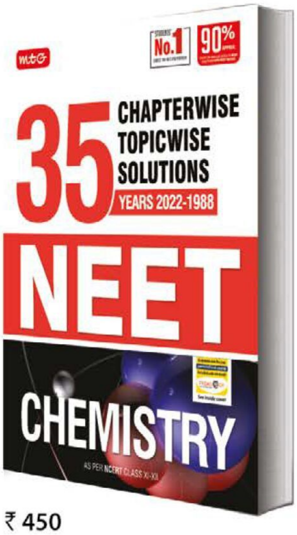
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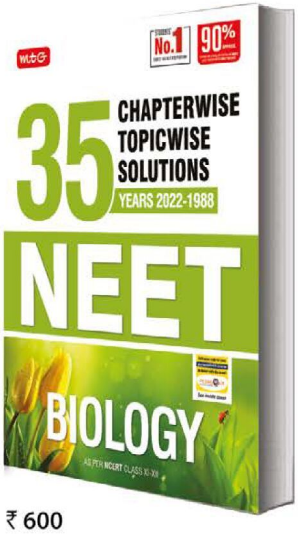
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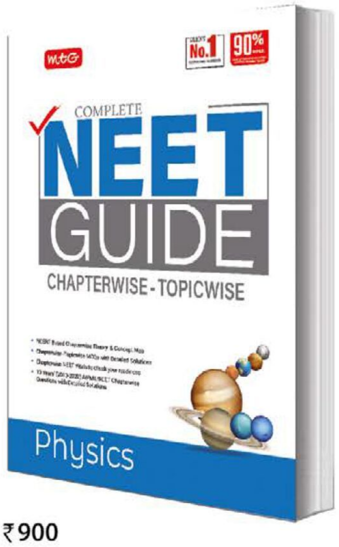
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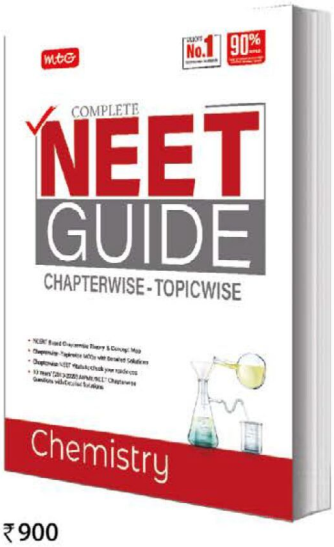
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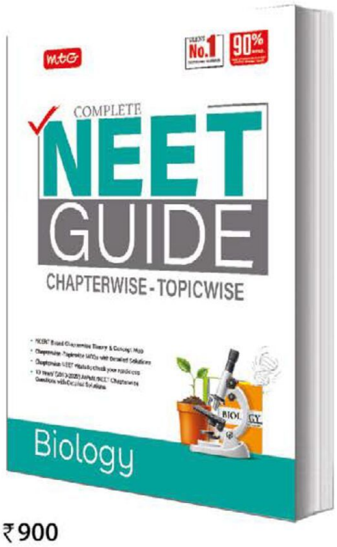
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